Railway Mechanical Engineer

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Winners in Hot Box Competition

The hot box competition, which was announced in the January and February issues of the *Railway Mechanical Engineer* and closed on March 1, aroused a wide interest among our subscribers in the car department. A total of twenty-six papers were submitted, many of which contain some excellent suggestions for the prevention of hot box epidemics, the sudden development of which frequently makes life miserable for the car foreman. The first prize has been awarded to a car foreman writing under the name of M. S. Roberts. The second prize has been awarded to Oscar Skegsberg, an assistant car foreman of Detroit, Mich. Several of the other papers were close contenders for the prizes and contain constructive material which will make them valuable contributions for the attention of our readers when they are published. The paper winning the first prize will appear in next month's issue.

Locomotive Inspection Pits Prove Value

While not unanimous, the opinion of by far the great majority of railroad mechanical men regarding inspection pits at engine terminals is favorable. Particularly in the case of busy terminals where many locomotives are conditioned for service and turned daily, the general experience has been that locomotive inspection pits on incoming tracks facilitate the immediate location of defects and enable those defects to be corrected and the locomotives returned to service more promptly. Many present terminals, where a sufficient number of locomotives are being handled, could doubtless be improved by the provision of inspection pits, together with a proper arrangement for the prompt transmission of inspectors' reports to the enginehouse foremen and supervisors. Locomotive inspection pits are usually of concrete construction, well drained and deep enough so that inspectors will have ample room to inspect the driving wheels, axles, boxes, binders, spring rigging, brake rigging, etc., without stooping in an awkward position which cannot be maintained. Particular attention should be given to the lighting arrangement so that on the darkest nights the pit lights will thoroughly illuminate the under parts of locomotives to such an extent that inspectors can examine them with practically the same degree of care as in the daytime. The importance of this feature in enabling slight defects to be noticed and corrected before trouble develops can hardly be over-emphasized. Another important feature of inspection pits is the possibility of making minor repairs on the spot as soon as they are discovered. This obviates entering these minor repairs on the inspector's report, saves the time of enginehouse forces which would otherwise be required to look up the locomotive and hunt around for the defect, and in general, greatly speeds the movement of locomotives through the terminal. One railroad which has recently taken advantage of this method of expediting engine terminal work is the New York, New Haven & Hartford. This road has within the past few months installed two locomotive inspection pits at its two Boston enginehouses, located at Dover street and Southampton street, respectively. Highly satisfactory results are said to have followed the installation of these pits, indicating that the expense involved in their construction was more than justified.

Drying Sand by Steam

The volume of sand handled at a large engine terminal warrants a careful study to determine the most economical way to prepare it for service. The two means most commonly used to dry sand are the coal stove and steam coils. The coal stove has been used for years and as the amount of sand used has increased with the size and number of locomotives handled, it has been found to be uneconomical and a dangerous fire hazard. The coal stoves have to be kept in operation twenty-four hours in order to maintain the supply. This materially increases the cost of drying sand on account of the continuous use of coal as a fuel and the labor required to handle the sand. The bins in which the sand is dried and stored are usually of wooden construction. These have been the source of serious fires which have resulted in greatly hampering the dispatching of power. A further delay results when the stoves burn out and have to be renewed. To overcome this expensive and dangerous method of drying sand a few railroads have installed at their important terminals large vats containing a series of steam pipe coils. The steam used to dry the sand is obtained from the exhaust steam line of the power plant. It has been found that for enginehouses dispatching on the average of one hundred locomotives per twenty-hour hours, that sufficient sand can be dried and stored by one man in eight hours to supply the terminal for the remaining sixteen hours. The fire hazard is entirely eliminated and maintenance cost is reduced to a minimum.

Do Your Jigs Save You Money?

Jigs and fixtures determine the output of the shop, and the utilization and the type selected is of primary importance. If a railroad invests a large sum of money in new machine tools and does not have suitable jigs and fixtures to hold the work the money expended for the tools is practically wasted. The development and utilization of jigs and fixtures is usually left to the initiative of the man in the shop or the foreman. Many jigs are developed under pressure such as in a case where a machine is holding up the work of a department to such an extent that it affects the output of the whole shop. This practice does not always get the best results on account of the short time allowed to give the job and machine sufficient study. This system also tends to bring haphazard results in efficient workmanship, as well as to produce a variety of fixtures instead of standard types. Take for ex-

ample, the jigs used for holding shoes and wedges on the table of a planing machine. If a census were taken of the different type of jigs now in use in the railroad shops throughout the country the total would startle the most conservative shop superintendent or master mechanic. Out of this number there must be one jig that is better than the rest. The only limiting condition in choosing the proper jig for this work would be whether the planer was being used entirely for shoes and wedges or for other work as well. It is not difficult to see the need of a careful study as to the type of jigs and fixtures that are being used in the shops. It is important that jigs be standardized and installed under proper and adequate supervision; a variety will not bring the most efficient and economical results. Every maintenance of equipment department should take the necessary steps toward the systematic study and development of the jigs and fixtures in all its shops.

The Vitality of the Steam Locomotive

One of the most striking characteristics of the steam locomotives is its vitality after a century of marvelous developments in the field of transportation which has produced the electric transmission of power, the automobile and the aeroplane. Circumscribed by limits of clearance, space and the severest kind of operating conditions, its development has never failed to meet the constant demands for greater capacity and greater efficiency. Many times it has appeared that the practical limit of development had been reached, but prophesies to this effect have always been followed by an improvement in an unexpected direction, which immediately showed their fallacy. Indeed, as the minds of engineers have become adjusted to the thought that the future possibilities were limitless because of the repeated demonstrations of the last two decades, there has even been an acceleration in the rate at which future possibilities were opened up. There probably have never been at one time more avenues of development opening up for the immediate future than are now evident. There is the 50 per cent cut-off principle which has thoroughly demonstrated its practicability and value under certain conditions as a means of increasing the economy and the adhesion capacity of the locomotive. There is the three-cylinder design, the possibilities of which have not yet been fully exploited, for increasing the adhesion capacity, the economy and the versatility of the locomotives of a single design for a wide range of service conditions. There is the possibility of using higher steam pressures through a departure from the conventional design of the locomotive boiler. There are the advantages of compounding, well established with relation to saturated steam and still attainable, though probably in a lesser degree, with superheated steam. All these developments are under active consideration at the present time. What is of most significance in the present situation is the open-minded attitude with which all of these developments are being watched by railroad men of all ranks. No better evidence than this is needed to prove the youth and vitality of the steam locomotive.

The "Waste in Car Repairs" Competition

A competition on the elimination of waste at outlying car repair points was announced in the March and April issues of the *Railway Mechanical Engineer*. Prizes of $50 and $35 were offered for the best and second best article written on this important subject. Seven papers were submitted which contained a number of constructive suggestions as to how wasteful conditions at outlying car repair points could be remedied. Considering the unsatisfactory conditions that are to be found at small car repair points on many of our railroads, one would naturally expect a greater interest to be shown in this subject, especially from the car men who work at such points. From the standpoint of supply, the stores department usually handles its part of the work quite efficiently. However, in many instances, adequate facilities are not available to take care of the material and tools used. Tools and repair parts cost money. Perhaps a road with only one or two such points does not find the waste to be a serious enough problem, in comparison with others, to give it consideration. From the standpoint of economy and efficient workmanship a careful study of this particular phase of car department work would be worth while. The paper, by W. A. Perkin, car inspector, Union Pacific System, Salt Lake City, Utah, to which the first prize has been awarded, emphasizes the necessity of providing proper storing facilities. The importance of frequent inspection trips was brought out in the paper by Arthur Schafnitt, car department foreman, St. Louis-San Francisco, Birmingham, Ala., which won second prize. The need of standard buildings and a uniform system of handling tools and material was mentioned in practically all of the papers. The editors of the *Railway Mechanical Engineer* appreciate the response of every one of the contributors to the announcements of this contest.

Speeding Up Car Repair Work

The volume of car repair work at rip tracks and car shops in this country is so great as to justify the large amount of attention given to many different plans for handling it and decreasing its unit cost. In recent months attention has centered primarily on straight line methods, and one of the most important advantages of practically any straight line method is the possibility which it provides of friendly competition between specialized gangs performing similar work. This organization is perhaps difficult to bring about at a rip track or small car repair shop handling light repairs, although it is probable that even in this case the use of straight line methods and specially trained men in competing gangs can be more generally adopted than at present. Wherever it is possible to put through the car shop a series of cars of similar type and requiring the same class of repairs, however, the possibilities of friendly competition between the gangs represents an unquestionable opportunity to increase the shop output. In many cases experience has shown that these cars can be started on their straight line movement over two or more parallel tracks. Necessarily the movement of the cars on each track must be made at the same time, which means that all the gangs on each track must complete their work simultaneously or hold up the entire track. Moreover, if the parallel track movements are made at the same time, there is a possibility of cross competition between the gangs on the respective tracks, with a highly favorable effect on shop output. It is an unquestioned trait of human nature that competition stimulates interest, and, while the result is undoubtedly increased production and harder work on the part of the men, the introduction of competitive gangs tends to promote renewed interest in the work; time passes more quickly; and the workmen are less fatigued mentally and perhaps also physically than if they spend the day watching the clock and trying to keep out of the sight of their foremen. No progressive railroad management in touch with the trend of the times has any idea of stimulating shopmen's activities beyond a point which can be maintained from day to day without harmful effects. There is no question, however, that within reasonable limits the competition between specialized gangs of car workers can be developed with a desirable effect on shop output and improved morale of the shop workers themselves.

Intelligent Locomotive Work Reports

Unintelligent, poorly written, finger marked enginemen's work reports are handed in all over the country, day in and day out, and constitute a hindrance to the enginehouse foreman in his task of keeping power in serviceable condition. "Driving boxes pound badly," "valves out of square," "engine does not steam," and such general statements do not mean a thing to an enginehouse foreman. An analysis of such reports generally shows that the older enginemen are the most serious offenders. It is an easy matter for the inspectors at the inspection pit to locate the apparent, external defects but it is the engineman's duty intelligently to report the defects existing on a locomotive under working conditions. It is assumed that when a fireman is promoted, he has a fairly good working knowledge of the machinery of a locomotive. An engineman consequently should specify in his work report what driving box is pounding, what valve and in which position does it work out of square, under just what conditions does the engine blow, and if the engine does not steam properly, why did it fail to steam. These and many other defects are of such a nature as to cause the enginehouse foreman and his men to lose their tempers as well as time and money for the company in trying definitely to locate the defects reported. Again, some enginemen know how to make out an intelligent report but scribble it down in such a manner that it is almost impossible to read it. If the engineman would take a little time to wipe the grease from his hands he could hand in a clean report instead of one smeared with greasy finger marks. Such reports tend greatly to hinder the making of proper repairs which, in turn, leads to engine failure on the road. To overcome this trouble steps should be taken to educate the enginemen as to just what is required of them in regard to making out work reports, and if they continue to hand in unsatisfactory reports disciplinary action should be taken so that satisfactory results may be obtained. The enginehouse foreman is frequently called on to answer for engine failures due to improper repairs. Would it not be time well spent by the higher officers of the department to attack aggressively one of the causes of these failures by making the enginemen hand in proper work reports, through closer supervision of these men on the part of the road foreman of engines?

New Books

AN INVESTIGATION OF THE FATIGUE OF METALS. *By H. F. Moore, research professor of engineering materials, University of Illinois Engineering Experiment Station, and T. M. Jasper, Research assistant professor of engineering materials, University of Illinois Engineering Experiment Station. 88 pages, 6 in. by 9 in. Price 45 cents. Published by The University of Illinois, Urbana, Ill.*

Bulletin No. 142 gives a detailed discussion of the theory of the fatigue of metals and substantiates the theory by numerous tests made in the testing laboratory. A chapter is devoted to resistance to reversed axial stress and also resistance to repeated stress other than reversed stress. The testing machines used to make the tests are fully described by text and illustrations. The test specimens used are recorded in tabular form giving the physical properties and preparation of each piece used. The text contains tables and graphs which give the data and results of each test. The summary of conclusions is given in ten paragraphs which are based on direct experimental evidence. The following facts are brought out in the conclusions. The endurance limits of wrought ferrous metals are much greater than originally thought to be. Repeated stress at or below the original endurance limit of a wrought ferrous metal raises the endurance limit of that metal and a repeated stress above the endurance limit lowers it. It is recommended that the endurance limit of the metal under reversed axial stress be considered as 60 per cent of the endurance limit under reversed flexural stress. An appendix to the Bulletin gives a supplementary bibliography containing the names of 55 articles dealing with the fatigue of metals. The subject is thoroughly discussed from every angle and the bulletin will prove a valuable aid to those who are interested in the fatigue of metals.

MAKING LETTERS TALK BUSINESS. *Edited by Sherman Perry, 184 pages, 6 in. by 9 in. Prepared and published by The American Rolling Mill Company, Middletown, Ohio.*

This book covers points of vital importance to the correspondent and the stenographer in the development of teamwork to the end that the letters may become more resultful. The text of the book brings out forcefully the absolute necessity of courtesy and naturalness in writing letters. A sample business letter is taken and the essential principles are discussed in such a way as to point out the most correct and effective practices. A chapter of the book is devoted to the Gregg shorthand method, giving the syllable division, and the primary and secondary accents used in the system. The principles of essential English as applied to business letters is thoughtfully discussed. Four pages of prepositions and their uses are included in the text. Throughout the book are scattered quotations, axioms and sayings which give the views and ideas of the best known writers and publications of the advantages of using the English language correctly so as to make business letters effective. It is a practical, well arranged book from which those who handle correspondence can receive many helpful suggestions.

What Our Readers Think

Consideration for the Hot Worker

LORAIN, Ohio.

TO THE EDITOR:

Only those who have filled the position of hot worker in a roundhouse have any real conception of the disagreeable features attendant on that position. These very evident features are so closely allied with it that to some supervisors it has practically amounted to a visualization of both the job and the holder as being minor agencies in the upkeep of engines in service. A greater fallacy could not exist.

There are two positions in a roundhouse that should be considered of the first importance—the hot worker and the boiler inspector. Unhappily such is not the case in the estimation of many who have charge of enginehouses. The consequences of filling both of these positions without consideration of the worker's qualifications have been both disastrous and expensive. The question arises: What constitutes a good hot worker? Answer: A good boiler maker. It is not exactly necessary that the hot worker should be a flanger or a layer-out, but he should be a man who has served his time as a shop boiler maker and a man with good judgment. A good hot worker knows that it is better to roll a flue that has developed cracks from the bead back into the flue than it is to take a fuller and calk the crack together as one would do with a fire crack in a flange or elsewhere. He also knows how much leaking staybolts should be hammered or worked over with the rivet pin, expecially if it is a full installation of flexible bolts. Good judgment is required there for too much hammering has a tendency to draw the sheet, thereby loosening up the adjacent bolts. Cracks in firedoor necks and elsewhere are taken care of in a manner

that will keep the engine in service until its regular shopping period.

He has his eyes open for leaking units at the firebox end, also for cracked or broken grates, mud blisters on the crown sheet and arch tubes, air leaks at front door ring, ash pan slides that do not close tight; he looks out for lost motion in the ash pan lever and shaft; sees that netting and plates in the front end are in good condition; that the blower is in position and in good repair. In some cases he has more than is here outlined, but enough has been covered to show how important the job is and how necessary it is that the hot worker be given the consideration that he deserves. There isn't much comfort in the job, but it can be made more pleasant by a little consideration.

He should have time to cool off before being called down on the floor for some other duty, and if he should happen to be caught taking it easy on the engine man's seat, don't bawl him out; he has probably just come out of the firebox where, surrounded by hot arch brick, leaking crown bolts dropping hot spots down his neck, flues spraying him with steam and hot water, the temptation has assailed him to forget that he is a boiler maker and for the moment become a butcher.

JOSEPH SMITH.

A Question and Answer

WINNIPEG, Man.

TO THE EDITOR:

It is customary in the shops where I work to rig up small hydraulic presses for pressing in bushings and such work. These presses are often made with the steam cylinder of an air pump as the driving power. My problem is, if the diameter of the steam cylinder is known to be 9¾ in., the steam pressure 100 lb. per sq. in., the size of the ram is 6 in. in diameter and the desired pressure 85 tons on the 6 in. ram, is it possible with this information, only, to find the diameter of the water cylinder required to give the desired pressure on the ram.

F. O. ROBINSON.

[You have a 9¾-in. steam cylinder with 100 lb. steam pressure per sq. in. By calculating the area of the 9¾-in. circle and multiplying this by the steam pressure, you will have the maximum possible piston load produced by the steam cylinder. Going now to the press, you can determine the water pressure per sq. in. required by calculating the area of the 6-in. ram and dividing this into the desired ram pressure of 85 tons. Having obtained this unit pressure and knowing the total load produced by the steam piston, if you divide the former into the latter you will have the area of the water cylinder plunger required. To find the diameter required you can readily find the diameter of the circle which equals this area. The figures thus obtained make no allowance for loss due to friction or other causes and to be on the safe side you would probably have to make some allowance.—THE EDITOR.]

Cutting Port Openings in Cylinder Bushings

CHICAGO.

TO THE EDITOR:

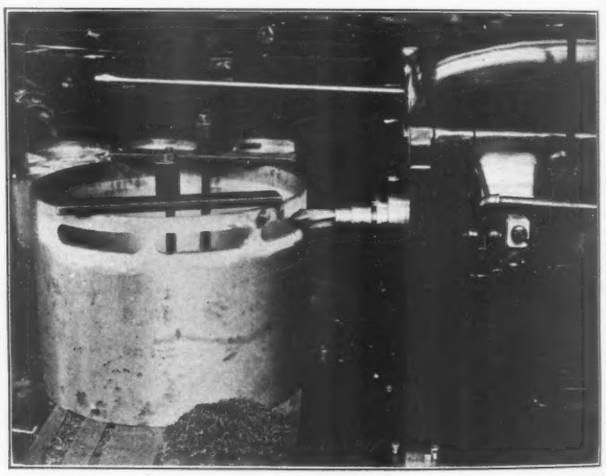
The illustration shows a method of cutting the port openings in locomotive cylinder bushings that may be of interest to those of your readers who are concerned with that particular job. It shows a Hunt-Spiller cylinder bushing held in place by two bolts and clamps. The only laying out necessary is for one hole at each end of the port openings.

A combined high speed steel drill and milling cutter is used to first drill the 1¾ in. hole, then the bushing is fed along the tool until the opening is completed. The clamps are then loosened and the bushing is moved into the correct position for milling the next opening, and so on until completed. The bushings shown in the illustration have three openings, each 7 in. long x 1¾ in. wide. These openings can be drilled and milled complete from floor to floor in less than 15 minutes.

It may be said that this work should be performed on a revolving circular table, but after trying out this method I do not think it is really essential, especially since in most cases the table would have to be placed in position for a small number of bushings and not all railroad shops are equipped with these devices.

The cutter was made from a milling cutter that broke while it was being used for milling the fork ends of a side rod. The broken end appeared almost like the one shown in the illustration and suggested itself for this sort of work, so it was ground and successfully tried out.

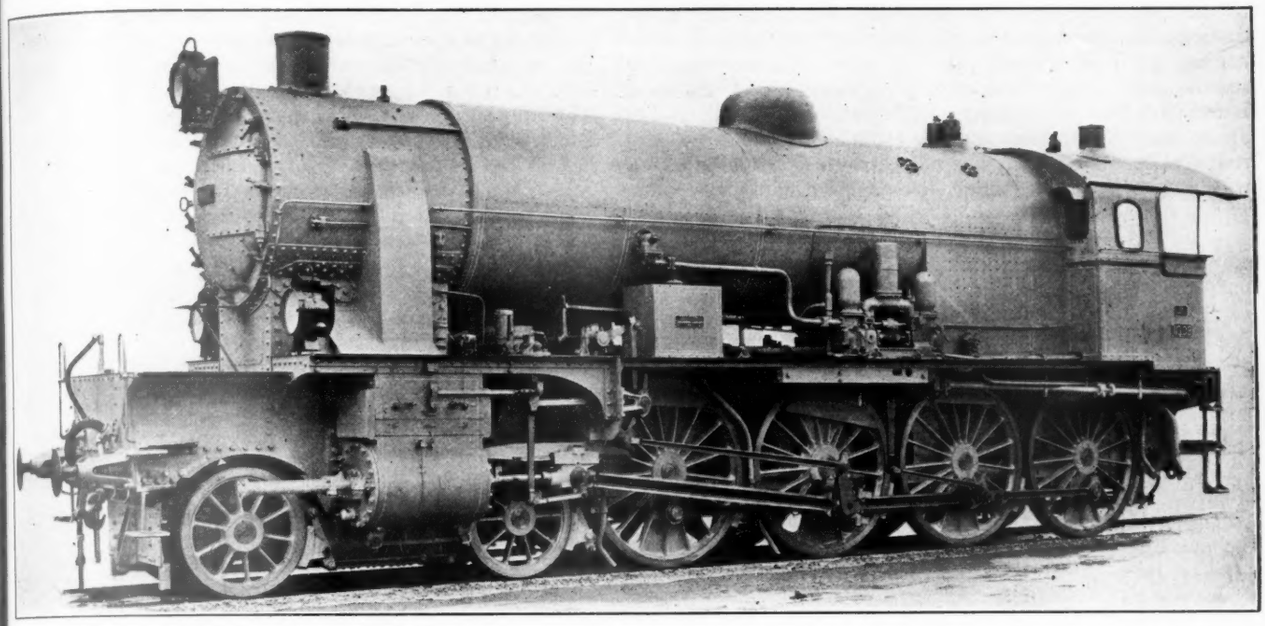
I have observed this particular operation being performed in various ways, many of which took anywhere from one to three hours to complete. I was recently in a shop where the openings were carefully laid off and the bushing placed on a drill press where several holes were drilled. Small holes were even drilled between the large ones and the bushing was then placed on a milling machine where the job was completed. Examples can also be cited where a hole equal to the width of the port was drilled in each end of the opening and then finished on a milling machine. Considerable embarrassment was caused when the foreman was asked why the second hole was necessary in each port when the milling cutter could complete it just as well without the second hole.



Cutting Port Openings in a Cylinder Bushing with a Combined Drill and Milling Cutter

While on the subject of cylinder bushings, I have frequently wondered why some roads follow the practice of making them in one piece. This entails considerable extra labor to machine and they are also difficult to apply and remove. The half length shown in the illustration can be bored, counterbored, turned and cut off in one operation on a vertical boring mill. I have been told that the inside of a one piece bushing which is first bored on one machine, and then the center plates applied and turned to a fit on a lathe, will tend to become so distorted that it is usually necessary to rebore after application. If the cylinder is round before the application of the two piece bushings, it is not necessary to rebore them when pressed in. Of course, care must be taken in facing them so as to get the faces true where the bushings join together.

OBSERVER.



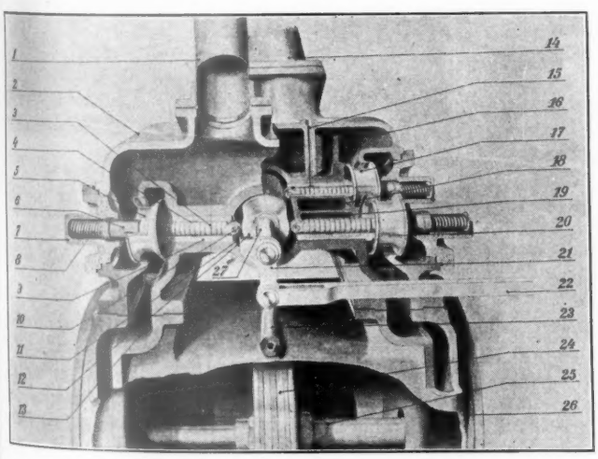
A 4-8-0 Superheated Express Passenger Locomotive Used on the Austrian Federal Railway, Equipped with the Lentz Poppet Valve Gear and the Dabey Feed Water Heater.

Development of the Lentz Poppet Valve Gear

Valve Gear Maintenance Costs, Lubricant, and Water Consumption Reduced on Austrian Locomotives

By A. Niklitchek

THE Austrian Federal Railways have succeeded in greatly increasing the efficiency of the modern reciprocating steam locomotive by the application of the poppet valve gear in place of the customary piston valves. At the present time the piston valves are applied only to very light power or to that designed for the highest speed.



1—Inlet pipe; 2—Poppet chest; 3—Poppet spindle; 4—Spindle Grooves; 5—Inlet valve; 6—Spindle guide; 7—Spring cover; 8—Poppet spring; 9—Poppet spindle guide bushing; 10—Poppet roller; 11—Cam space; 12—Inlet cam; 13—Inlet port; 14—Exhaust pipe; 15—Lubricating groove; 16—Exhaust port; 17—Exhaust valve; 18—Exhaust port; 19—Inlet port; 20—Inlet valve; 21—Cam shaft arm; 22—Cam shaft arm connecting rod; 23—Cylinder lubricating pipe; 24—Piston; 25—Piston rod; 26—Cylinder; 27—Cam shaft.

Fig. 1—Arrangement of the Lentz Poppet Valve Gear

Austrian locomotive designers for a long time had experimented with the poppet valve gear but had been unsuccessful in developing one which could meet the difficult service requirements of locomotives. Nevertheless they continued their efforts in the belief that the piston valve, with its high maintenance costs, resistance to motion and steam losses, was a very inefficient means of steam distribution. The long delay experienced in applying the poppet valve to the locomotive was due to the defective design of the whole gear. The poppet valve, which had long proved its efficiency on the reciprocating stationary engine, was difficult to adapt to the severe and irregular conditions met with on the locomotive.

After many years of experimenting at the Steg Locomotive Works, Vienna, with which company the Austrian Federal Railways and the Southern Railway of Austria co-operated, it is believed that the problem of the application of the poppet valve to locomotives has been solved and that the design developed has had sufficient trial to prove its ability to meet every operating requirement.

Since 1922 all new locomotives ordered by the Austrian Federal Railways have been equipped with the Lentz poppet valve gear. Locomotives so equipped have been handling heavy traffic on the steep gradients of the Austrian Alps without any difficulty. The consumption of coal and lubricants has been materially decreased by the application of these valves and valve gear maintenance costs on these locomotives have been reduced to practically nothing. When it is recalled that the Austrian railways have to import nearly three-fourths of all their fuel, it is apparent that the attention paid to fuel economy has been well placed.

Description of the Valve

Fig. 1 gives the details of the Lentz valve gear as used on the Austrian Federal Railways, showing the upper part

of the cylinder and the poppet chest containing the steam-distributing elements—the poppets, the cam shaft and the cams. There are four poppets, one for admission and one for the exhaust for each side of the piston. The cam shaft is engaged by a lever attached by means of a Woodruff key at its outer end, which lever is actuated by the connecting rod of the gear. The device is designed for application with any type of valve motion, so that modernizing antiquated

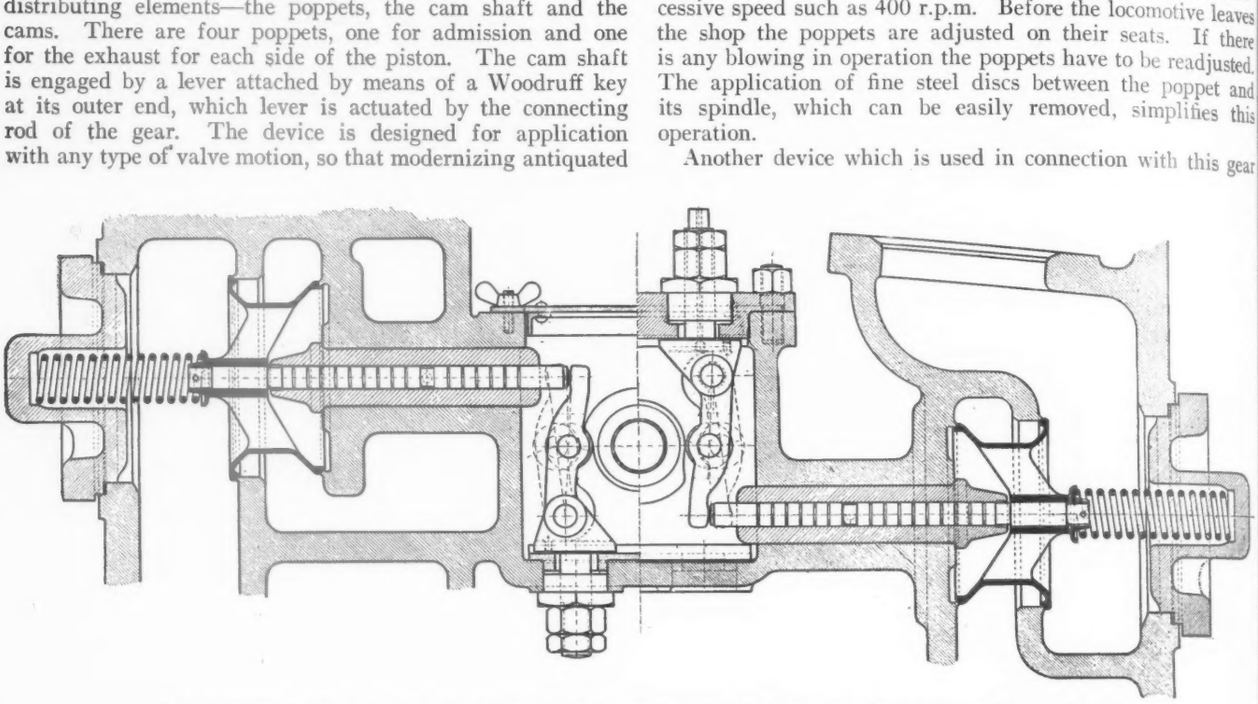


Fig. 2—Poppet Valve Gear with Intermediate Lever Located Between the Cam and the Poppet Spindle

power by the application of the poppet valves will not necessitate the provision of new valve motion. The separation of the introduction and exhaust of steam secures the well known thermic advantages.

The poppet valve chest is of cast iron and includes the channels, seats and partition walls for the poppets and holes for the guidance of the poppet spindles. It is fixed on the cylinder by means of two flanges. The poppets are of the double-seated balanced pattern and, in order to reduce their weight, they are drop-forged. The thickness of the walls is only ⅛ in. Experiments are now being conducted with poppets of a high grade of cast iron. The poppets are guided by a hollow spindle, made of chrome-nickel steel, the

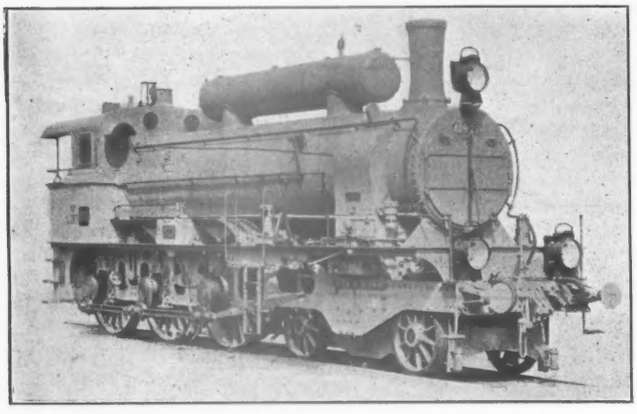


Fig. 3—Superheated Passenger Locomotive Rebuilt and Equipped with the Lentz Valve Gear

end of which is provided with a roller of hardened steel which makes the contact with the cam. The labyrinth protects against steam losses caused by blowing between the spindles and guides.

Each poppet is, as shown in Fig. 1, pressed upon its seat by a spring. The tension of this spring is so proportioned as to secure contact between the lever and the cam even at excessive speed such as 400 r.p.m. Before the locomotive leaves the shop the poppets are adjusted on their seats. If there is any blowing in operation the poppets have to be readjusted. The application of fine steel discs between the poppet and its spindle, which can be easily removed, simplifies this operation.

Another device which is used in connection with this gear is shown in Fig. 2. These are intermediate levers located between the cam and the poppet spindle. They have a double function—first, the lengthening of the poppet stroke and,

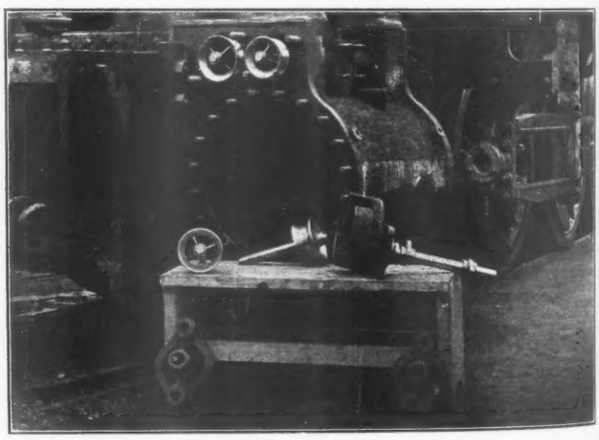


Fig. 4—The Four Poppets and the Cam Shaft of the Lentz Valve Gear

second, they give an opportunity for accurate regulation of the beginning of the poppet stroke.

The Austrian Federal Railways have made thorough tests of locomotives of the same class, some equipped with the poppet valve and others with the piston valve. The locomotives thus tested are of the 2-10-0 heavy freight type. These tests have shown that the chief advantage of the poppet valve consists in the reduction of repair and maintenance costs, 40 per cent to 50 per cent decrease in the consumption of lubricants, and fuel and water economy averages of from five to eight per cent.

Many of the locomotives equipped with a poppet valve gear have also a Schmidt small tube superheater which delivers steam to the valve chamber at from 820 deg. to 840 deg. Fahr. The tests of the locomotives equipped with this type

of superheater have not as yet been completed, so that definite results cannot be given. The performance of this type of superheater, however, seems to depend largely on the length of the boiler and the quality of the coal. It has been found that the superheater does not perform at its maximum efficiency when brown coal is used.

Excellent results have been obtained with old locomotives which have been modernized by the application of the superheater and the poppet valve gear. Fig. 3 shows a rebuilt 4-6-0 type of the Austrian Southern Railway which has been equipped with a small tube superheater, poppet valve gear and a Dabeg feed water heater. This locomotive is now able to handle the same traffic as locomotives with the same wheel arrangement which were built 15 years later. The tractive effort of this locomotive has been increased 40 per cent, showing clearly the advantages of the use of highly superheated steam. At the present time there are 42 locomotives equipped with the Lentz poppet valve gear.

Fig. 4 shows the principal parts of the poppet valve gear. One exhaust and one inlet poppet valve extend from the steam chest. On the bench is shown the cam shaft containing the inlet and exhaust cams. These cams are made from chrome-nickel steel. The illustration also gives a good idea of the accessibility to the various parts of the gear.

Analysis of Feed Water Heating Devices

Feed Water Heaters with Pumps Take More Heat from the Exhaust Than the Exhaust Steam Injector Type

By E. P. Gangewere

DURING the last few years, considerable activity has been manifested in locomotive feed-water heating. Broadly speaking, devices on engines today, may be divided into two classes: feed-water heaters with pumps, and exhaust steam injectors.

In order to fully understand the savings afforded by each of the above devices, it might be well to study the heat interchanges involved in their use. This will, of course, not deal with the mechanical construction, or operation of either device. As is well known, steam under pressure has energy by virtue of two conditions; namely, kinetic energy, or that part capable of doing external work, and potential energy, or that part which is due primarily to the heat in the steam. The feedwater-heater pump and exhaust steam injector use both energies of the steam, to various extents.

In order to better illustrate the points at hand, a typical set of figures has been taken. We will first consider the exhaust injector:

Boiler pressure (gage).....200 lb.
Heat in steam at 215 lb. abs.....1199.2 B.t.u.
Exhaust steam from cylinders of locomotive (at 15 lb. gage back pressure, initial temp. 625 deg. F.).....1163.9 B.t.u.
Assumed tender water temperature..... 38 deg. F.

Considering the first stage of operation of the injector, the exhaust steam, and water from the tender, are here mixed together.

Temperature of delivery from first stage (assumed)..... 140 deg. F.

Since the heat lost by a body during a heat transfer cycle, must equal the heat regained by another body, we have:

W_t equal weight of water from the tender.
$1163.7 - (140 - 32) = W_t\,(140 - 38)$, or
$W_t = 10.3$ lb. per lb. of exhaust steam from the cylinders.

In the second stage of injector the previous mixture is here augmented by live steam from the boiler. The mixture entering the second stage consists of 10.3 lb. of tank water and 1 lb. of exhaust steam. Since the combining tube ratio must remain the same, we can compute the final delivery temperature from the following formula:

T=final delivery temperature.
W_1=weight of live steam.
W_m=weight of mixture (tank and exhaust steam water).
W_{ex}=weigh of exhaust steam.

Hence:

$$\frac{(T-140)\ 11.3}{W_1} = \frac{W_1\ (1199.2 - 140 - 32)}{W_{ex}}, \text{ and}$$

$$\frac{W_m}{W_t} = \frac{1}{10.3}$$

Since $W_m = 11.3$ lb. and $W_1 = 1.1$ lb. live steam.

Therefore from above equation:

T=244 deg. F.

Assuming that the exhaust steam from the cylinders and water from the tank was lifted a distance of 10 ft., the external work performed would be 10 x 11.3 = 113 ft.-lb.

Internal work performed would be 1199.2—(244—140) = 1095.2 B.t.u. transferred to the feed mixture, per lb. of live steam used.

Heat in steam at 215 lb. abs.....1199.2 B.t.u.

Allowing the pump exhaust to heat the water from the tank, this being a condition when the locomotive might be drifting, with no exhaust steam from the cylinders.

Assume in this case:
Feed temperature, = 60 deg. F.
Pump exhaust back pressure, same as cylinder back pressure when the engine is working=15 lb. gage.
Assume adiabatic expansion to 15 lb. gage; heat in the steam=1050 B.t.u.
Hence: $1050 - (60 - 32)\ W_1 = W_t\ (80 - 32)$.
W_1=1 lb. live steam.
W_t=36.5 lb. tank water.

Now utilizing the cylinder exhaust at the above back pressure, and assuming a final delivery of 210 deg. F., and that quantity of exhaust reclaimed is in each case proportional to the increase in fluid temperature; we have:

$(210 - 60)\ 37.5 = W_{ex}\ (1163.7 - 60 - 32)$, or $W_{ex} = 4.86$ lb. exhaust steam from the locomotive cylinders.

The external work performed is 10 $(36.5 + 4.8)$ = 413 ft. lb. The internal work performed is 1050 — (60 — 38) = 1028 B.t.u.

From this analysis we draw the following conclusions:

The total work of the injector per lb. of live steam is $(1095.2 \times 778) + 113 = 852{,}178$ ft.-lb. The total work of the pump per lb. of live steam is $(1028 \times 778) + 413.0 = 800{,}197$ ft.-lb. or 51,981 ft.-lb. in favor of the injector.

Considering the results of the analyses on an exhaust steam reclaimed basis. For the injector the amount reclaimed per lb. of live steam used is $\frac{1}{1.1}$, or .9 lb. For the pump, the amount reclaimed per lb. of live steam used is 4.8 lb., by previous calculation.

The total heat reclaimed from exhaust steam by the injector is .9 (140 — 38) = 91.8 B.t.u. The total heat reclaimed from exhaust steam by the pump is 4.8 (210 — 60) = 720 B.t.u. The above figures are based on 1 lb. live steam consumption.

The real criterion of efficiency, then is the amount of heat reclaimed from the exhaust steam per lb. of live steam used. Practical advantages, however, will determine in all cases, which device might be used on a locomotive.

Relation of Locomotive Design to Maintenance

Proper Consideration Given to Design of Parts Facilitates Repairs at Reduced Cost

By Charles Raitt
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THE relation of design to maintenance is a vital one on locomotives. As soon as a locomotive leaves the builders' or the repair shop and enters service the process of wear begins and adjustments, repairs, or renewal of parts are needed to keep it in good condition. The facility with which these adjustments, etc., can be made in great measure determines the cost; the design and arrangement of parts determines the ease or difficulty experienced in adjusting, repairing, or renewing them, and is, therefore, of first importance.

There are so many designs of locomotives in service that it is difficult to treat the subject constructively and to avoid a general discussion of theories as applied to different types rather than to deal with it from the point of view of the running repair force which is the registrar of the cost of locomotive maintenance to the management of the railroad.

Generally speaking there is no pronounced difference of design between passenger and freight locomotives, yet the difference is such as to affect materially the cost of maintenance. The height of driving wheels on passenger power renders accessible for repairs many parts which present quite a problem on low wheel freight locomotives of the 2-8-2 or 2-10-2 type, particularly the spring rigging, driving brake equipment, attachments between frame and boiler, decks and cross frame braces. Too frequently a common design is followed without regard to the fact that the larger number of low wheels, almost totally blanked with counterbalances, and closer centers renders access easy on the one and a laborious task on the other. The balance in favor of maintenance cost of passenger locomotives is largely due to that fact.

The vital importance attached to the fact that the design and accessibility of locomotive parts has a direct bearing on maintenance cost is emphasized in this article in such a manner that the designer can hardly fail to recognize an opportunity to make his work a big factor in the reduction of maintenance expense.

Some of the heavier machinery maintenance items common to all classes of power are main driving box pounds, adjustment and securing of driving wedges, and taking up lateral on engine truck and trailer wheels. Increasing the size and length of main bearings adds to their life, but it must be admitted that the refitting of main brasses every 15,000 to 25,000 miles on heavy freight power, and from 35,000 to 50,000 miles on passenger locomotives indicates a lack of balance yet to be solved. The three-piece main brass with adjustable parts to take up wear may give some relief, but it would seem that a transfer of weight to the other drivers, with corresponding counterbalance and rod strength, is the way out. The wedge bolt as a means of adjusting and holding driving box wedges, is admittedly poor, ineffective and expensive and it is often necessary to supplement it with blocks between the wedge and binder to get results. On roads with sharp curves the enginehouse truck gang has a perpetual job removing engine truck and trailer wheels to take up lateral. A design of box is needed, fitted up for removable hub plates that will be easy to apply without removing the wheels or boxes. This has been successfully worked out on some roads but its value is not generally recognized.

Frame and Boiler Connections

Loose deck castings and cross frame braces demand expensive repairs. They have increased as cast steel has replaced iron castings. The greater strength of the steel permits a proportionate reduction in weight with the result that the web or flange where it is bolted to the frame is often too light to give holding surface for the bolts, so they work loose and holes have to be re-reamed and new bolts applied at intervals. A built-up hub is required around the holes to insure material enough to resist bolt wear.

Periodical and expensive repairs are required to maintain braces between the main frames and the boiler. These connections are usually made by fastening twin angle irons to the barrel of the boiler with studs or rivets, then bolting a piece of boiler plate between the angles. The bolts at the angle irons bear all the upward thrust of the frames, soon break or become loose, and, very often, start the studs or rivets leaking in the boiler. Experience has shown that there is not only no advantage in having braces between the frames and the boiler studded to the boiler but that it weakens the boiler sheet and induces cracks between the stud holes which require expensive repairs. It has been demonstrated that where these attachments are required, such as at the overhang of guide yokes and valve gear supports, the boiler should be reinforced originally at the point where the brackets are attached, and the supporting brace hinged to take care of boiler expansion without undue strain.

The furnace bearers or expansion rests between the fire box and the frames are a prolific source of trouble, and are neglected more than they should be. As a rule they are too short, have no provision for lubrication and, as a consequence, grind loose and allow a jumping motion between the frames and the boiler which makes a hard riding engine. When the upper part of the pad or rest is shorter than the lower it grinds downward. In the absence of other means of correcting this, sheet iron shims are provided to take up the slack which, as a rule, are applied on top of the shoe because it is the easiest way. In time this creates a heavy strain between the boiler and the frame which prevents free expansion of the boiler. A case came to my observation some time ago where the upper parts had ground into the lower over ¼ in. with a square shoulder at each end of the worn surface. They were shimmed down and when the boiler was fired up, prevented expansion until the strain became so great that when released suddenly it ruptured the boiler sheet through 26 rivet holes at the second course connection. The importance of having furnace bearers of adequate design to insure free movement is, therefore, apparent.

Spring Rigging and Brake Equipment

The maintenance cost of spring rigging on certain classes of power is perhaps more than any other one feature governed by design. The free movement of springs in saddles and a means of lubricating equalizer and hanger pins should be provided. These pins should not be doweled or rigidly held for, if left free and oiled, they will be found to turn, thus improving the riding of the engine as well as doubling the life of the pins. Slotted spring hangers passing through spring ends and supported by narrow gibs should be replaced by hangars passing around the spring with a suitable steel clip casting between the spring and the hangers. All hanger pins should be placed so that new springs can be applied without the necessity of jacking up wheels or removing other frame attachments.

The suspension pins of driving brake hangers are very often a source of trouble on freight locomotives on account of being placed behind the tires and applied from the outside. Safety hangers and brake rods frequently interfere with the packing of driving box cellars. These conditions can be remedied if given consideration by the designer. Trailer and engine truck braces should also be located so as not to interfere with a quick job of applying a brass or packing a cellar on the road.

Revolving and Reciprocating Parts

Of the many designs of back end main rod connections, that type with the adjusting bolt threaded through the adjusting wedge is probably the least desirable as the thread becomes distorted by the thrust. The strap connection is too cumbersome on heavy power and the strap bolts hard to remove and replace. The solid end and floating bushings in both main rods and main connections are economical by reason of convenience in renewing, and, if properly fitted, will give 20,000 miles service on the heaviest power. The short bearing of side rod knuckle joints involves frequent renewal of pins and bushings, but because of the limited wheel clearance it affords little chance of improvement, except in the matter of providing lubrication, which is often neglected.

Of the two types of two-bar crossheads now in general use the alligator type is the most economical on account of centering up with the cylinder. When constructed so that the outer plate can be removed and gibs shimmed or renewed instead of having to remove and babbitt the spacing blocks, it effects a decided saving in maintenance cost. The two-bar type crosshead with underhung piston requires much heavier guide bars, and should be reinforced with a cast web underneath and just back of the wrist pin, and with another at the extreme rear end under the bottom guide bar to prevent overstrain on the sides when the wrist pin is tightened. This is to avoid vibration cracks under strain as well as to prevent cramping the front end of the main rod.

The universal use of superheated steam has revolutionized piston construction. The solid piston head is almost extinct and the cap style follower bolt on built-up heads is gradually vanishing, taking the old snap ring with it. Bull rings with from two to three inches added material in the lower segment to withstand wear, with concave cylinder heads to provide clearance for it, add very much to the life of piston heads and permits of their being built up substantially. Follower plates fastened with through bolts simplify the removal of bull rings, and section cylinder packing with steel expander rings seems to be the most serviceable and economical piston construction to date.

Proceedings of the Railway Fuel Association

A Large Attendance with a Heavy and Varied Program Marks the Sixteenth Annual Convention

MORE than 700 members were in attendance at the Sixteenth Annual Convention of the International Railway Fuel Association, which was held at the Hotel Sherman, Chicago, May 26 to 29 inclusive. The interest of the members was sustained throughout a heavy program covering all phases of the railway fuel problem, from the selection and inspection of coal at the mine to the proper firing practice in the final consumption of both oil and coal on the locomotive.

The principal features of the opening session were the addresses by R. H. Aishton, president of the American Railway Association, and Charles Donnelly, president of the Northern Pacific. Mr. Aishton's address, reported in some detail, follows. Mr. Donnelly devoted his remarks to the proposed consolidation of railroads into a limited number of systems as outlined in the Transportation Act. The association was also addressed by G. W. Reed, vice-president of the Peabody Coal Company, Chicago, and M. A. Daly, president.

President Daly outlined the history of the Fuel Association accomplishments during the last year, describing the important results secured by the prize contest for the best paper on fuel economy. He referred to the growth of the International Railway Fuel Association in size and said that it has come to be regarded as an authority on fuel matters, having received such recognition by the American Railway Association, the Bureau of Railway Economics and the Interstate Commerce Commission.

Election of Officers

The following officers were elected for the coming year: President, P. E. Bast, Fuel Engineer, Delaware & Hudson; vice-president, E. E. Chapman, engineer of tests, Atchison, Topeka & Santa Fe; vice-president, J. W. Dodge, Illinois Central; vice-president, J. R. Evans, chief fuel supervisor, Chesapeake & Ohio. The following new members were elected to the Executive Committee: O. J. Brown, superintendent fuel service, Boston & Maine, two years; T. C. Hudson, assistant general superintendent motive power, Canadian National, two years; A. W. Perley, Oregon-Washington Railroad & Navigation Company, two years; W. J. Tapp, fuel supervisor, Denver & Rio Grande Western, two years; and J. M. Johnston, fuel supervisor, Missouri-Kansas-Texas, one year. The association voted to hold its 1925 convention at Chicago.

Mr. Aishton's Address

Equally with everybody connected with the railroad service, and with the public who are dependent on its use, you are also vitally interested in the future destinies of the railroads, their success or failure, and I know of no body of men who have any greater individual influence on their welfare than you and your associates on the battle line of the railways who have to do with the fuel problem.

What is your problem? Considering the aggregate of

the coal used on the Class I railroads of this country the figures are so startling that we are apt to get lost, and the use of such figures suggests enormous and unlimited sources of supply. I am just going to quote a few figures to paint the picture:

Total fuel consumption, 1923 (includes fuel oil, equated)	146,500,000 tons
Made up as follows:	
Freight	90,000,000 tons
Passenger	32,000,000 tons
Switch	24,500,000 tons
Total	146,500,000 tons
Total cost	$507,000,000
Average cost fuel per ton, all fuel	3.46

You are all familiar with the measure of freight service, commonly called 1,000 gross ton-miles. One of the large measures of efficiency and economy in moving a thousand tons a mile is how much coal is burned in that operation. Last year it took 160.2 lb. of coal turned into steam to move one ton of gross freight 1,000 miles, or 1,000 gross tons one mile, which, by the way, is 2.8 lb. less than 1922 and 1.8 lb. less than 1921.

I have in my hand a pound of coal. It doesn't amount to much in looks, and few of us would stoop to pick it up or refrain from kicking it down the bank, but in that one pound of coal as applied to 1,000 ton-miles lies the greatest opportunity for economy that I know of. I won't say how many millions or billions of ton-miles were made in the course of the year. Suffice it to say that if you were to move a ton of gross freight 1,000 miles, and did it with that pound of coal less than you used in 1923, and moved the same ton mileage as in 1923, you would have saved in the aggregate 561,987 tons of coal, which at the prevailing price would mean $1,944,000 less than in 1923. Is that worth going after? You men know better than I how you can do it. In the same way, applying that same degree of saving, one pound of coal out of every 160.2 lb. used in passenger service, would save 200,000 tons of coal valued at $692,000. If you applied that same degree of saving to the fuel used in switch service and for other purposes, such as stationary boilers, stations and for heating purposes, etc., it would mean a further saving of 153,000 tons, or $529,000, making an imposing total of $3,165,000 less cost than would have been incurred provided the same amount of fuel was consumed per 1,000 ton-miles as in 1923.

We hear a great deal nowadays regarding scientific investigation, development of methods and appliances for bringing about wholesale greater economies in fuel, and while they may and no doubt do possess possibilities, in my opinion we must take cognizance of the fact that they all have one present vital disadvantage and that may be briefly expressed in the term, capital expenditures. Capital expenditures depend on the earning power of a railroad, and unless the necessary capital can be secured at reasonable terms—and this is, in turn, dependent on the net revenue of the railways—it is absolutely futile to talk about large capital expenditures until conditions improve, although we all may know that such expenditures would produce a good return to the railroads.

Furthermore, do not overlook the fact that in the last two decades every known appliance for producing economy has been installed on new locomotives and to a very large extent on the larger locomotives as they go through the shops, and while I won't undertake to say what the total capital expenditure has been, in the matter of superheaters alone it runs up over $125,000,000, and in 1923 there was programmed and being installed superheaters to the value of practically $7,000,000. In addition to that, large amounts of capital have been put into brick arches, stokers, coal breaking appliances, self-closing firebox doors and all the appliances with which you are familiar that it is claimed add to economy, besides liberal installation of numerous experimental devices not yet proved but which may lead to economies in labor and fuel costs.

What we have got first and immediately to attack is the problem as it is—the tools as they are in our hands today—and by the application of knowledge, initiative, and a desire to bring about accomplishment, get an immediate result out of these vast capital expenditures. There is hardly an activity or an employee in any department of the railroads who does not have an opportunity to save on fuel consumption and to play his particular part in saving that pound of coal.

M. A. Daly (Northern Pacific), President

J. W. Dodge (Illinois Central), Vice-President

P. E. Bast (Delaware & Hudson), Vice-President

For example, take the mechanical department. Is your design of a locomotive such as to bring about the most economical use of fuel? I don't know much about back pressure, but I do know something about an automobile. I know when I have carbon in the cylinder I burn more gas, create less power and bring about more dissatisfaction than is the case if I don't. Isn't back pressure something like the carbon in your cylinder? Are your exhaust ports, exhaust passages and exhaust nozzles properly designed? In other words, when your steam has done the work is the freest possible outlet given it to the atmosphere? The cut-off and the speed also have something to do with back pressure. In Europe, I understand, they think this is so important that on a good many of the railroads they have a gage in the cab that shows just what the back pressure is. It adds to the effective manipulation of the locomotive to get rid of the steam when used, promptly and without delay

and if the necessary steps can be taken to save any of the back pressure incidentally it is reflected in reduction of fuel used. I simply cite this to indicate the importance of this question of back pressure, not with the idea of even suggesting putting gages on locomotives, but to indicate that investigation and care on the part of everybody in avoiding back pressure may bring about a decided improvement.

Take the operating department. I just read a paper by W. L. Richards, an engineman of the Union Pacific, on the advantages of pre-classification. That's its long name. What it really means is switching orders or switching shipping tickets instead of cars, and holding cars when necessary to avoid extra switching and in some cases, movement to destination in train lots. This item alone will save you a pound of coal and more in switching service.

How about standby time at engine terminals? I have just read a statement in the March number of the Engineers' Journal that steam locomotives burn some 29,000,000 tons of fuel while they are out of action—standing by in yards or roundhouses waiting to be put to work. What about it? Whether the amount is over-stated or not, is there not some opportunity for economy?

Improved locomotive terminals are more than mere mechanical contrivances offering means for reducing the cost of handling locomotives at the end of their run and conditioning them for the next run. They are operating features. Every hour that you can save for a locomotive at a terminal is that much to the good, not only in the actual saving of coal but in the use made of the locomotive investment. I will venture the assertion that in this one item alone you can pick up a part of that pound of coal I referred to. I don't know of any subject that will be more productive of useful information than a close check of means and methods, particularly the latter, to bring about a more intensive use of locomotive investment. This goes into everything—into the management of ash pits, shaking of grates, etc.—and the desire on the part of everybody and every department to keep this locomotive moving, because when the locomotive is standing still it is not only the investment in the locomotive but a lot of other investments that are non-productive.

You have had in the past years papers without number from scientific bodies, from our great universities, from technical and practical experts, and the latest development was a series of most excellent papers brought out by a competition inaugurated by your association, and in those papers practically every phase of this fuel subject has been covered. It would be useless for me to stand up here this morning and tell you of the things that have been written, and which you have read, on all these various matters. Just get out of your head that it is a big problem—it isn't; just get out of your head that it is wholly a scientific, technical problem—it isn't; all the science and technique in the world is powerless alone and without back of it the determination to do the job right; just get out of your head that it is Bill Jones' problem—it isn't. It is your problem. Just get into your head that in this pound of coal, and in your personal relation to it, lies the answer to the question.

Fuel Losses at Locomotive Terminals

This paper, by W. A. Kline, general road foreman of engines, Central of Georgia, contained constructive suggestions for the saving of fuel. The author considered with great thoroughness the possibilities of fuel economy by proper cinder pit operation, cleaning flues, washing boilers, loading tenders, lubrication, applying stack covers, building fires, etc. He pointed out that thermic syphons assist in the prevention of terminal fuel losses due to the increased area of firebox evaporative surface enabling locomotives to be fired up more quickly.

Increased circulation also tends to promote this end and adds to the durability of the boiler by the prevention of excessive expansion and contraction stress.

Regarding fuel economy meetings on the Central of Georgia, Mr. Kline said: "We have found that our monthly fuel meetings, presided over by the superintendent of terminals or division superintendent are of great value in bringing to our attention any condition that will reflect on the economical operation of locomotives. At these meetings the men themselves act as a committee of the whole and they are invited to make constructive criticisms of the power and any conditions causing fuel losses.

"These meetings are very interesting and are well attended. The master mechanic and his staff is present, listening to the complaints of the men and making notes concerning the conditions as outlined by those present. The questions discussed at these meetings meet with prompt handling.

"The men who blow flues, the fire-up men, the boiler inspectors and clinker pit men are present to give and receive suggestions concerning terminal losses. At these meetings fuel economy is discussed from every angle and the suggestions received from the men are of great value. The minutes of these meetings are published and made available for every man on the system.

"Fuel meetings as we hold them promote a fine, healthy family spirit, bringing the men and management closer together, bringing about team-work and co-operation. The meetings teach our men and officers to give thoughtful consideration to each other's rights. They bring about better understanding and appreciation of each other's viewpoint. They have improved the high quality of the service which the railroad endeavors to render."

In addition, Mr. Kline's paper makes definite recommendations regarding the most desirable scoop sizes and methods of handling coal.

Discussion

Several members referred to the saving in coal which may be effected by banking the fires of locomotives held over night at outlying terminals. B. J. Feeny, Illinois Central, advocated this practice, and then cleaning the fire two or three hours before the time for the locomotive to leave the terminal in the morning. This leaves nothing but dead ashes next to the grate to be dumped, with a good bed of live coke which may be spread over the grate after the fire is cleaned. If the fire were cleaned immediately on the arrival of the locomotive, it was estimated that from 1,000 to 1,500 lb. of good fuel would go through the grate into the ash pit.

On the St. Louis-San Francisco, at outlying points handling from three to eight locomotives, the fires are never knocked during the week, but are banked every night and then knocked out on Sundays. At larger terminals, it has been the practice to cover the grates with paper through which holes have been bored in the roll, before laying new fires. This prevents the loss of a considerable quantity of fine coal through the grates, the holes providing for sufficient draft to start the fire.

On the Denver & Rio Grande, W. J. Tapp stated that it is regular practice to make some one man responsible at every terminal for the carrying out of firing-up instructions and to see that new men hired for this work are thoroughly instructed in the standard practices.

L. G. Plant, National Boiler Washing Company, emphasized the importance of studying all of the possibilities for saving fuel at terminals inasmuch as approximately 25 per cent of all locomotive coal is consumed at terminals. He stated that 100 boiler horsepower, operating two hours, is required to fire up a locomotive, and that best practice requires 30 boiler horsepower for from one to one and one-half hours, and suggested the possibility of conserving part of this by direct application of steam to the locomotive boiler, rather than through the blower. The use of soot blowers, which

may be operated while a locomotive is in service, was also pointed out as a possible means of effecting considerable saving in terminal fuel consumption because it makes unnecessary the dumping of fires in order to clean tubes between washout periods.

Report of Committee on Fuel Stations

The American Railway Association's committee on design of shops and engine terminals at the 1923 convention of the Mechanical Division in reporting on the consolidated terminal plan had the following to say about coaling stations:

"Coaling stations may be of modern mechanical type or the older gravity tipple, the type selected usually depends on the number of engines handled, the number of tracks available for coaling engines and the kind of coal used.

"Station capacity should be at least 24 hours' or better still 48 hours' supply for maximum demand. The storage bins should be made self-cleaning as far as possible by proper sloping of floors. Gravity tipple outlet fixtures may be of the under cut or over cut type, preference is shown for the over cut gate as it seems to provide more even mixing of coal delivered.

"Mechanical coaling stations should be of the transverse type and a station serving several tracks is preferable to the longitudinal type because it facilitates engine movement to and from the station."

The committee suggests that an analysis be made of the feasibility of the plan for using a traveling crane and clam shell, with overhead storage limited to 360 tons as compared to mechanical type chutes where the overhead storage capacity is at least 100 per cent more than the daily issue of coal to locomotives. It has often been the case that a sufficient amount of overhead storage took care of the coaling of locomotives without delay during an emergency caused by a breakdown to the machinery.

One of the more recent methods of auxiliary ground storage adjacent to coaling stations was developed in the dragline and scraper plan, by which the coal is elevated from the track hopper to the top of coal chute building and dumped through a long spout to a point on the storage plot where it is available for handling with the scraper. This method of handling midwest bituminous and western lignite coals is not exactly what is desired. The handling movements are too violent and cause excess breakage and slacking of this friable coal, whereas this same effect would not be much in evidence in handling the harder variety of coal produced in the eastern and southeastern part of the United States.

One of the most important essentials in the use of mine run coal is to deliver it onto locomotive tenders in even mixture of the coarse and fine particles, by which means a more uniform firing efficiency is possible. Most of our storage bins are hoppered to one side and have entirely too much plan area permitting the coarse coal to roll to the outer edge and the slack or fines to settle in the middle or under the point of discharge when filling the bin. It is a common thing to find that the grade will differ on each one of a group of locomotives coaled from such a station. As a corrective plan, the consideration of bins not to exceed 10 ft. in diameter and hoppered to a central outlet is suggested. Added capacity can be obtained by increased heights or additional bins.

Operating stoker and hand fired locomotives out of a terminal requires fairly close sizing of the coal to each class of engine if fuel conservation is to be maintained. Two general methods may be taken to accomplish this sizing, viz: Coal may be sized at the mines and hoisted separately into assigned pockets in the coaling station; or coal may be received as mine run, reduced to 6 in. and under through breaker bars on the track hopper or passed through a crusher and then sized by passing the reduced coal over a screen. The separate products are discharged to different pockets.

Shaker screens, similar to those in use at the mines have been used, but the additional machinery and rigid structure required for their installation, together with the possibility of a shut down due to failure, favors the selection of a rigid bar screen.

The coal issue to stoker and hand fired locomotives at the Clinton, Illinois, terminal of the Illinois Central is divided about 50-50. The coaling station is of concrete and the storage pocket is divided in two by a concrete partition perpendicular to the coaling tracks. The roof and hoisting tower is of structural steel. The latter detail facilitated the alterations, for had the entire structure been made of concrete, the scheme would have had to be changed.

In order to maintain the original storage capacity of the overhead pockets, the hoisting tower was increased in height 9 ft. 6 in. and the dumping point of the buckets raised a corresponding amount. A timber partition was framed between the concrete partition and the end walls of the bin, thus dividing the bin into four pockets. The coal is discharged over the bar screen, the oversize being discharged to either the two right hand pockets and the undersize to either of the two left hand chutes equipped with gates.

The bar screen is 8 ft. long and 12 ft. wide, inclined at 30 deg., the bars are of 1½-in. square steel stock set on edge, making it what is commonly known as a diamond bar screen. The lower end of each bar is bent at right angles and rests in holes in the lower dead plate. The bars are spaced 4½ in. centers, thus making a clear space between the bars of 2½ in., the resulting product being about 6 in. by 3 in. oversize and 3 in. undersize. It was found that this spacing delivered 47 per cent to the hand fired pockets and 53 per cent to the stoker fired pockets. This preparation is close enough for all practical purposes, as a variation of the amount of coal issued to the two classes of engines would cause the quantity of the oversize to accumulate faster than the other and vice versa, so that it was necessary at times to veil a portion of the bar screen to increase the amount of hand fired coal and at other occasions some of the bars were removed to increase the quantity of the stoker fired coal.

This report was submitted by the following committee: L. J. Joffray (I. C.), Chairman; E. E. Barrett (Roberts and Schaefer Company), G. F. Bledsoe (Ogle Construction Company), W. S. Burnett, J. C. Flanagan (Fairbanks, Morse and Company), J. W. Hardy, W. T. Krausch (C. B. & Q.), A. A. Meister (S. P.), Frank Rasmussen, H. D. Savage (Combustion Engineering Corporation), T. W. Snow (T. W. Snow Construction Company) and E. J. Summers (C. M. & St. P.).

Discussion

Reference was made to an electrically operated device for coaling locomotives at small points where only a few locomotives are handled daily. The equipment includes a pit into which the coal is dumped directly from cars of the self-cleaning type, and then handled from the pit direct to the locomotive tender. In case coal is received in flat bottom cars, it can be handled direct from the car to the tender. In the case of the installation described, the coaling facilities are located some distance from the ash pit so that the coal and ashes have to be handled separately.

The importance of dividing large bins up into smaller bins was also emphasized as a means of preventing a too extensive separation of the fines and lump into different parts of the bin and causing a lack of uniformity in the coal delivered to the locomotives. In this connection, it was also suggested that mine operators be induced to provide loading aprons which put the coal into the car lengthwise and thus avoid accumulating all of the slack on one side of the car, as is the case when the coal is shot into the car transversely.

[Abstracts of other papers and reports will appear in next month's issue.—Editor.]

Apprenticeship Methods on the Santa Fe*

Thorough and Adequate Training in the Shop Is Insured by Having Special Shop Instructors

Part II

THE fault with many systems of apprentice training has been the neglect of shop training. Many railroads and industrial plants have established apprentice schools wherein the apprentices were taught drawing, mathematics, and other subjects, all of which were good so far as they went, yet the scheme failed because the young apprentice boy was left to the mercy of a very busy, overworked foreman who was being pushed for immediate shop output and had little or no time to devote to the green, inexperienced boy, nor to the training of those older in service. Oftentimes the helpless apprentice was kept on some one job for a year or more, coming out of his time a one- or two-job mechanic. Under such conditions it is no wonder the scheme failed. The apprentice was neither developed into a skilled all-around mechanic nor made efficient even on the work to which he was assigned.

Apprentices and Instructor in the Blacksmith Shop

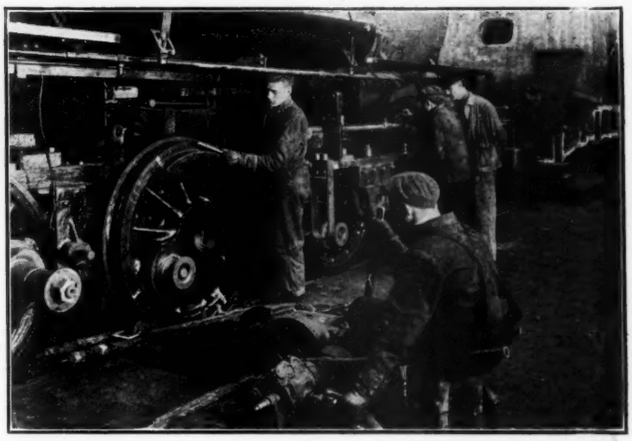
Foreman Too Busy to Instruct Apprentices

The old way of placing a new boy in the tool room to hand out tools, or with a mechanic under the guise of a helper, or putting him to sweeping the floor, or to cleaning up machines, has no place under modern methods of apprentice training. The apprentice must be made to produce, must make things to be used, so he can go home with a heart full of joy and tell his father or mother, "I made a bolt for Engine 976 today, all by myself."

The foreman in a modern railway shop has too many other duties and is too hard pushed for immediate output, to be expected to give to the inexperienced, untrained apprentices the instruction and painstaking attention needed to develop them into skilled all-around mechanics. He must cooperate, but the responsibility for this training must be placed upon someone with no other duties to perform. Neither must the men upon whom the responsibility for this training is placed be given charge of too many apprentices. Just as certain training systems have failed on account of confining the instruction to that given in the school rooms, so have other systems failed which provided only one apprentice shop instructor regardless of the size of the shop or the number of apprentices in his charge.

A Shop Instructor for Every 20 Apprentices

No phase of the plan of training given apprentices on the Santa Fe has given such immediate or permanent results as that resulting from the shop instruction of apprentices. An apprentice shop instructor has been assigned for each department, or one for about every 20 or 25 apprentices. This instructor has no other duties than those relating to training the hands, the eyes and the judgment of the apprentices in his charge. He is not responsible for the output of the shop or the output of any machine but is assigned to his duties solely for the purpose of seeing that the apprentices learn quickly and are taught the most improved and modern methods of operation. Increased immediate output of the shop is one of the results of his work but this is considered of far less importance than the ultimate development of skilled mechanics.



Instructing Apprentices in Setting Valves

Each shop instructor must be a boy-loving man, a first-class mechanic of his trade, patient and active and above all, capable of inducting some of his knowledge into the boy—one who not only knows but knows how to tell what he knows. He takes the boy in hand, and if a machinist apprentice, starts him out on some simple machine, first showing him the different parts of the machine, how it is controlled and operated, what safety precautions to take in order that his fingers, arms, or body may not be endangered, also to be on the lookout at all times for the safety of his fellow workmen. He teaches the apprentices the function of each machine, the necessity for taking proper care of machines, how work should be placed, how tools should be ground and set, what speed and feed to use, proper methods of bench and floor work, the assembly of parts, the relation of one part to another, the whys and wherefores of performance of

* This is the second of a series of articles descriptive of the apprenticeship system of Atchison, Topeka & Santa Fe. The first one, appeared in the June issue. The next article will be devoted to the instruction given apprentices in the shop schools.

these parts; in fact, everything they may need to know in connection with the work assigned them.

He encourages them to ask questions and by precept and example inspires them to take full advantage of the opportunities offered. There are apprentice shop instructors not only in the machine shop, but also in the boiler shop, the blacksmith shop, the paint shop, the cabinet shop, and in the freight car shop.

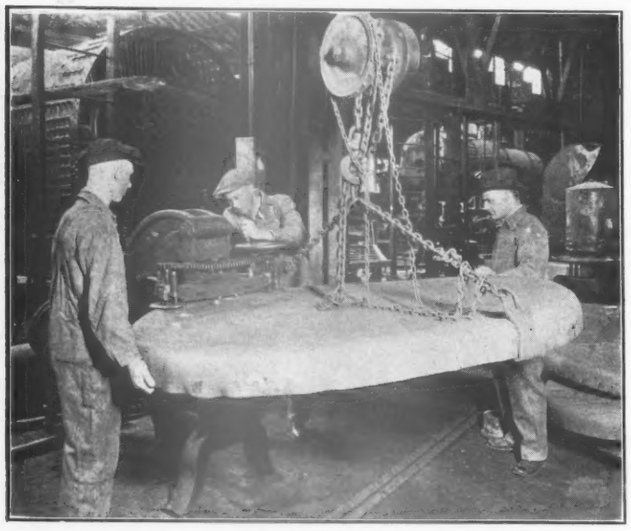
Shop Instructors Responsible for Changing Apprentices

It is the shop instructor's duty to see that each apprentice is moved from machine to machine, from one class of work to another, from machine to floor, from floor to bench, etc. Foremen and instructors work in harmony, without friction and with the fullest co-operation. The foreman is responsible for the output of the shop, the instructor for the instruction and training each apprentice needs. The foreman may assign the work to the various machines, but the instructor knows which apprentice is best fitted for performing the work in question and which apprentice is in most need of the experience offered. He places the apprentices accordingly and is at hand to see that the work is properly performed.

Changes in machines or work assigned apprentices may be made at any time but in general are made on a certain date each month, the foreman and the apprentice usually being notified in advance of the changes about to be made. Knowing that he will be assigned next month to a certain coveted machine, the apprentice observes the work carefully and when so assigned can generally go ahead with little instruction.

Definite Schedule of Shop Work

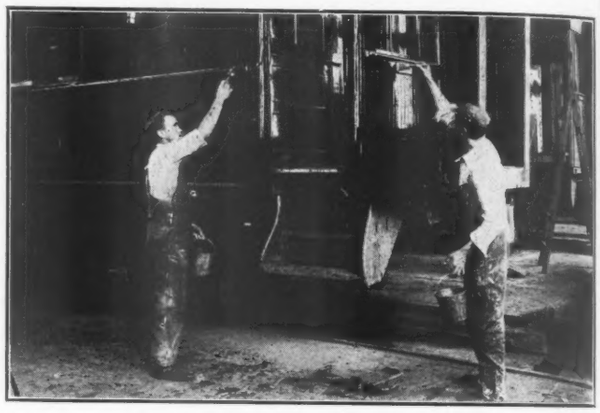
A definite schedule of shop work has been mapped out for apprentices of each trade, so as to insure each apprentice in that department having a fair and impartial show. These



Instructing Boilermaker Apprentices on Flange Work

schedules show the different classes of work on which each apprentice must receive experience and the time allotted to each. They vary according to the opportunities offered at each shop. They are arranged according to the intricacies of the work so that the apprentice may gradually advance from the simple to the more difficult classes of work. The time allotted to each machine or class of work has been so equated that the apprentice may become reasonably efficient upon each.

This does not mean that he is necessarily kept on each job the full-allotted time without rotating. There are times when conditions will justify pulling him off one class of work and trying him out on another in order to give himself confidence, he being later returned for further experience on the work from which he was removed. Neither is it understood that the schedule must always be followed exactly in the order specified. It must be made sufficiently flexible to meet the exigencies of the shop but followed closely enough to prevent the apprentices being used merely as a matter of convenience. The instructor must see to it that at some time during the period of apprenticeship each apprentice is given experience on all the classes of work stipulated in the schedule for that trade. He must keep each boy busy, never allowing an apprentice to hunt him up for another job. He should have his work so laid out that the boy always has a job



Painter Apprentices Varnishing a Coach

awaiting him. He has the authority and must change the boys from one class of work to another in accordance with the specified schedule. Failure to make these changes on scheduled time deprives the apprentice of full time on some subsequent job, and deprives some other boy of the full opportunity he should receive on this job.

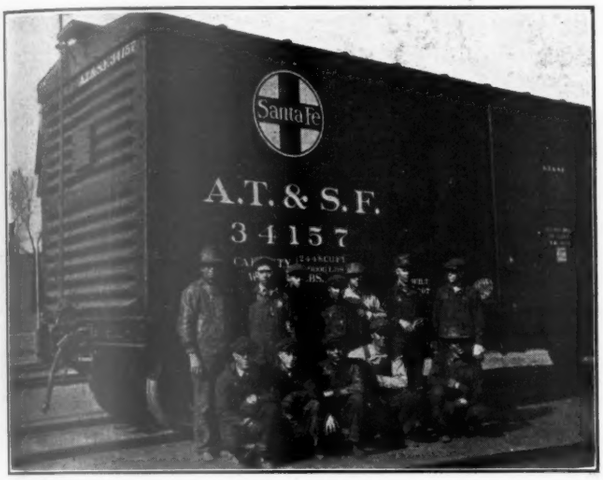
Individual and Group Records Shows Actual Experience

A detailed record is kept of the shop work of each apprentice. This record, a copy of which is sent to the supervisor of apprentices each month, is made in loose leaf form, a separate sheet for each boy, and shows the number of days' experience on each class of work to which the apprentice is assigned, and the month and year in which this experience was given. It shows also the number of days off during the month, the total number of working days in the month being accounted for, so that there may be an accurate, indisputable record of just what experience is given each apprentice. This record also shows the quality of work done on each class of work—whether excellent, good, fair, medium or poor—thereby showing for which class of work the apprentice shows most fitness. This information is of value in determining to what class of work to assign the apprentice when he completes the course.

In addition to the individual shop record of each apprentice, further record is kept on a large sheet for each trade. This record shows at the top the schedule of work for apprentices of that trade at that particular shop and the time allotted to each class of work, and at the left the names of the apprentices of that trade and the hours served by each. The shop instructor enters in pencil on this sheet the number of days' experience given each apprentice on each class of work, making the necessary corrections or additions once each month so that it constantly shows at a glance the total experience each apprentice has thus far been given and the class of work still to be given him before graduation.

This record is of great assistance to the instructor in show-

ing at a glance how closely the experience actually given each apprentice conforms to that of the prescribed schedule. For instance, the instructor in the machine shop can see at a glance just what machines each apprentice has already had and to what machines and erecting work he must still be assigned before completing his apprenticeship. Incidentally this record shows supervising officers how faithfully the instructor is carrying out the instructions given him to see that each apprentice is given full variety of experience on all classes of work of his trade. If the instructor has been



Freight Car Rebuilt Exclusively by Apprentices, Showing the Instructor and Apprentices Who Did All of the Work, Including Carpenter and Steel Work, Trucks, Air Brake Work, Painting and Stenciling; the Actual Man-Hours Were Less Than the Average for Full Rated Carmen

negligent, this record will show it. This record is also of great value when apprentices are desired for any particular class of work. For instance, if apprentices are desired for lathe work, or for milling machines, or any other work, this record shows just what apprentices are available and best fitted for, or most in need of this particular class of work.

Thorough Experience Guaranteed

Space does not permit showing all these schedules for the various trades and shops, but representative samples are shown in the illustrations. The schedule shown for the machinist trade is one adopted for one of the larger shops. Note the wide range of work on which each apprentice is given experience, and that apprentices from these larger shops are given six months' roundhouse experience. Apprentices from the small roundhouse points are likewise transferred to one of the large shops for back shop experience. Similar transfers are made with boilermaker and sheet-metal worker apprentices.

Note from the schedule of work prescribed for boilermaker apprentices the varied classes of work offered. Few boiler makers in the land received such a wide range of experience. Blacksmith apprentices receive experience on light fire, medium fire, and heavy fire, spring work, heating and helping at the steam hammer forge, operating light forge machinery, operating steam hammer, autogenous welding, etc. The schedule for sheet-metal worker apprentices includes experience in tin shop, babbitt shop, freight car shop, on

SHOP SCHEDULE FOR FREIGHT-CARMAN APPRENTICES AT TOPEKA, KANS.

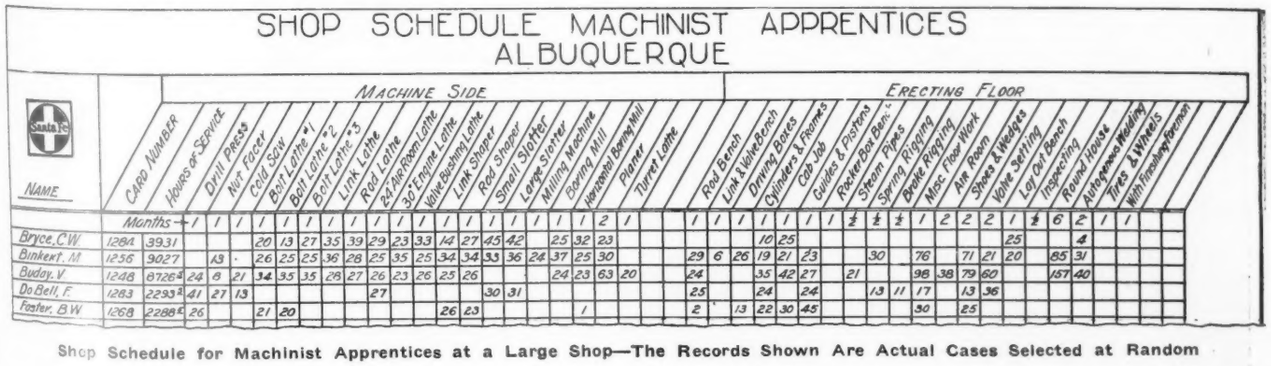
General Car Body Work	Months
Wood body work, Safety appliance, Side and end doors, Underframe, Draft gears	14½
Oiling and packing	½
Trucks and wheels	4
General steel work	4
Inspection	1
Total	24
Air Brakes	
Cylinder cleaning	1
Triple valves	1
Pipe work	2
Testing	2
Total	6
Mill Work	
Saws, Planer and gainer, Mortiser and boring, Layout	6
Miscellaneous welding, etc.	½
Grand total	36

jacket work, locomotive pipe work, passenger car work, water service work, brazing, welding and roundhouse work.

Painter apprentices are given outside and inside body work, experience in spraying, in locomotive painting, in stock room, in lettering, stenciling and sign painting. The

SHOP SCHEDULE FOR BOILERMAKER APPRENTICES AT LA JUNTA, COLO.

Back Shop	Months
Heating rivets	¼
Light sheet iron, cabs, running boards	3
Tanks	2½
Ash pans	2½
Front ends	2¼
Staybolts, radial tate, flex. exp. bolts	4
Autogenous welding	4
Flues, arch tubes, flue shop	4
Sketching and special work	1
New fireboxes	2
Flanging and layout	4
Patches	4
Firebox sheets	4
Flue sheets and braces	4
Total	42
Roundhouse	
Grates and hot work	2
Ash pans, front ends	1
Electric arc flue welding	1
Staybolts, radials, flues	1
Inspecting and testing staybolts	1
Grand total	48


SHOP SCHEDULE MACHINIST APPRENTICES
ALBUQUERQUE
MACHINE SIDE
ERECTING FLOOR
Santa Fe
NAME
CARD NUMBER
HOURS OF SERVICE
Drill Press
Nut Facer
Cold Saw
Bolt Lathe #1
Bolt Lathe #2
Bolt Lathe #3
Link Lathe
Rod Lathe
24" Air Room Lathe
30" Engine Lathe
Valve Bushing Lathe
Link Shaper
Rod Shaper
Small Slotter
Large Slotter
Milling Machine
Boring Mill
Horizontal Boring Mill
Planer
Turret Lathe
Rod Bench
Link & Valve Bench
Driving Boxes
Cylinders & Frames
Cab Job
Guides & Pistons
Rocker Box Bars
Steam Pipes
Spring Rigging
Brake Rigging
Misc. Floor Work
Air Room
Shoes & Wedges
Valve Setting
Lay Out Bench
Inspecting
Round House
Autogenous Welding
Tires & Wheels
With Finishing Foreman
Months
Bryce, C.W. 1264 3931 20 13 27 35 39 23 29 33 14 27 45 42 25 32 23 10 25 25 4
Binkert, M. 1256 9027 13 26 25 25 36 28 25 35 25 34 34 33 36 24 37 25 30 29 6 26 19 21 23 30 76 71 21 20 25 85 31
Buday, V. 1248 8726[4] 24 8 21 34 35 35 26 27 26 23 26 25 26 24 23 63 20 24 35 42 27 21 98 38 79 60 157 40
Do Bell, F. 1283 2293[2] 41 27 13 27 30 31 25 24 24 13 11 17 13 36
Foster, B.W. 1268 2288[4] 26 21 20 26 23 1 2 13 22 30 45 30 25

Shop Schedule for Machinist Apprentices at a Large Shop—The Records Shown Are Actual Cases Selected at Random

schedule shown for freight carman apprentices shows the thoroughness of the shop training given this class of apprentices. Certainly the graduate of any of these courses should be an all-around mechanic.

Space does not permit a detailed account of the sequence

of training given apprentices of the different trades. Suffice it to say that for the machinist trade it has been found preferable to start the apprentice on machines and end up on the floor. Machine work is more interesting than floor work to a young boy. Moreover when starting his apprenticeship the boy is young and soft, and often unequal to the heavy floor work which a modern locomotive requires. During his first six months, or probationary period, the apprentice should have experience on three or four different machines, as it should be incumbent upon everyone having anything to do with his training to determine during this period whether he has sufficient talent for development and is capable of mastering the trade. He must be kept interested, for at 16 he is restless and not accustomed to the daily grind or to the monotony of doing the same thing hour after hour, day after day. He is in the shop to learn a trade and must have a fair chance—a boy's chance. His ambition should not be killed.

Results of Shop Training

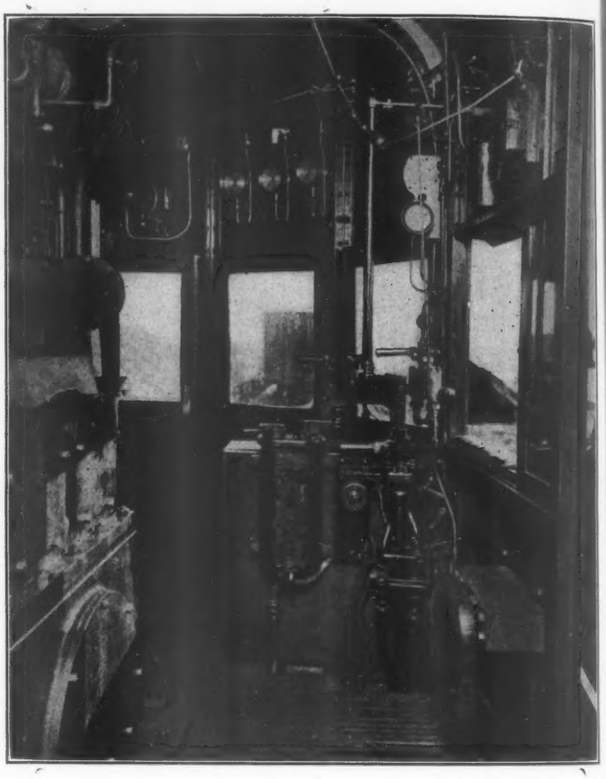
The apprentice should never be used as a matter of convenience. His development into a skilled mechanic is paramount to the immediate work performed. He is indentured to learn a trade and this feature should not be lost sight of in the desire for a large output from the shop. The apprentice on the Santa Fe is given an opportunity, the best that can be given anywhere. The purpose for which the apprentice is employed—the making of skilled mechanics for the shops and roundhouses—is ever borne in mind. Needless to say, the additional work performed by these apprentices because of the instruction and training given them, more than offsets the cost of their training. The more than 16 years' experience on the Santa Fe has shown that the cost of the shop instructors' salary should not be considered an expense but rather as an investment from which inestimable returns have already been received.

Oil-Electric Locomotive with Injection Type Engine

AN electric locomotive, driven by a fuel-oil engine, the first of its kind built in America, has been built jointly by the General Electric Company and the Ingersoll-Rand Company. This has been especially designed for switching service and is receiving its first practical test by the New York Central in its freight yards on the west side, New York City.

Front End View of the Oil-Electric Locomotive Built Jointly by the General Electric Company and Ingersoll-Rand Company

The power plant equipment consists of a 300-hp. oil engine, manufactured by the Ingersoll-Rand Company, directly connected to a 200-kw. General Electric generator. The direct motive power consists of four HM-840 General Electric motors, one of which is geared to each of the four axles.



Interior of the Cab, Showing the Throttle and Controller—the Oil Engine Is at the Left

The locomotive has a total weight on the drivers of 60 tons.

The six-cylinder engine is designed to burn fuel oil according to the principles of the well-known Price system of direct fuel injection. This system avoids the use of high pressure injection and also effects a reduction in weight, an improvement in mechanical efficiency and increased simplicity and reliability. The fuel is injected into the various cylinders through a distributor by a single acting plunger type pump.

All parts of the cylinders, cylinder heads and combustion chambers are water cooled. The water from the water jackets passes to a radiator located on the roof and a thermostat maintains an even temperature irrespective of weather conditions. The muffler for reducing the noise of the exhaust is also mounted on the roof. Sufficient fuel can be carried for 48 hours continuous switching service.

The engine consumes about 0.43 lb. of fuel oil per brake horsepower. Owing to its high economy it is free from smoke, which renders it particularly suitable for service in cities or in places where smoke is objectionable. As ordinarily used in switching service, the locomotive has consumed about 20 to 26 cents worth of fuel oil per hour.

The unusual feature of the design of this locomotive is the use of a direct current generator supplying current to the motors without intervening accelerating resistances. This is accomplished by using a differential series field on the exciter, which automatically reduces the generator voltage with the increase in the amount of current drawn by the motors. The speed, therefore, automatically increases as the load is reduced, corresponding to the rise in impressed voltage.

Unit System for Freight Car Repairs

Fixed Applied Piecework Labor Costs Per Car Used as the Basis of Output

By J. McClennan
General Shop Inspector, New York Central, Buffalo, N. Y.

THE opportunity for railroad executives to compare the performance of their large and small repair plants, representing millions of investment, rests largely upon the manner in which their mechanical department heads arrange to report output. Inquiry has failed to disclose the existence of any reporting method other than the light, medium and heavy segregation, under which, for example, a light repair job is one consuming under 20 hours, a medium 20 to 50 hours and a heavy job 50 hours and over, unaccompanied by any supporting unit output basis to eliminate those spreads which induce inaccuracies of comparison. The majority of the roads operate on a piece work basis or some adaptation thereof and establish money limits for each of the above classifications, based on about 63 cents an hour. The range of heavy freight car work is so wide that proper comparisons with previous performance are impossible under the existing classification.

The light, medium and heavy segregation is not sufficiently illuminating because it restricts to three classes important work which should be reported under at least eight, and it lacks a proper summary by units. The reporting of repairs on the basis of expended hours is erroneous because the hour

REPORT OF FREIGHT CARS REPAIRED

MONTH_____ 19____ SHOP_____
DIVISION_____ DEPT. HEAD_____

Class	Class No. 1		Class No.2		Class No.3		Class No.4		Class No.5		Class No.6		Class No.7		Class No.8	
Hours	Under 20		20-50		50-80		80-110		110-140		140-170		170-200		200 & up	
Applied P.W.cost	Under $12.60		$12.60-$31.50		$31.50-$50.40		$50.40-$69.30		$69.30-$88.20		$88.20-$107.10		$107.10-$126.00		$126 & up	
Ratio each class to all	.01		.04		.07		.10		.14		.18		.20		.26	
	Car No.	App.P.W. cost	Car No.	App.P.W. cost	Car No.	App.P.W. cost	Car No.	App.P.W. cost	Car No.	App.P.W. cost	Car No.	App.P.W. cost	Car No.	App.P.W. cost	Car No.	App.P.W. cost
1.																
2.																
3.																
4.																
5.																
6.																
7.																
8.																
9.																
10.																
Total cars and cost																
Total same mo.lt.yr.																
Total last mo.																

Summary	This Year	Last Year	Last Month
A. App.P.W.cost-grand total of above	*		*
B. Output units $\left(\frac{A \times 1}{.63}\right)$			
C. Man hours applied labor			
D. Output units per man hour $\frac{B}{C}$			
E. Ave. P.W. hourly rate			

* If schedules were advanced 5 per cent since last year the applied P.W. cost should be divided by 105 per cent.

A Proposed Form for Reporting Freight Car Repair Output for Comparison by the Piece Work Labor Cost System

is not indicative of output, and its use borders on the trial and error process, although it must be resorted to at shops working on a day basis. The use of money limits without equating them for each general advance or reduction in labor costs destroys the comparison of output with previous years.

The ideal output unit is probably the labor and material cost of repairs per pound. Railroad executives know they can buy new locomotives for about 16 cents a pound, steel coaches for about 18 cents a pound, steel box cars for 6 cents a pound, steel hoppers for 5.5 cents a pound, etc., but it is apparent that the accounting cost of reporting freight car repairs on a pound basis would be prohibitive.

The managements will always insist on reports showing the number of cars repaired, but they are entitled to a comprehensive report along these lines which will more accurately reflect the true conditions.

Piece Work as a Basis of Output

It is suggested that fixed applied piecework labor costs per car be used as the basis of output, as they represent accurate indices of work accomplished. These applied piecework costs are usually uniform at all shops on a given road, and the information is available at every shop and repair branch for payroll purposes immediately upon completion of the car, and would therefore not involve additional expense for the purpose of the output report.

Piecework unapplied labor costs incidental to each car receiving repairs such as milling the lumber, manufacturing the forgings and fabricating the steel should not be considered, as the fabricating machinery, and consequently the piecework costs of such unapplied work, would vary at all shops, thus destroying one of the main purposes of the proposed output report which is to compare output of one shop with another. The motor horsepower determines the cubic inches of given metals which can be removed per minute on lathes, shapers, millers, drills, slotters, etc., when using the same grade of high speed steel in cutting tools, but the setting up time is a variable which would negative a miscellaneous output comparison on machine work. Furthermore the unapplied or machine labor is only about 15 per cent of the applied labor.

Proposed Car Repair Form

The report blank illustrated would in the writer's opinion furnish data entirely acceptable to executives desiring a continuation of output reports which are based on the number of cars put through each large and small shop. It provides in lines *A* to *E* a real output unit comparison. The ratio of each class to all classes is shown for statistical purposes.

The rate used to produce the applied piecework labor cost is .63 cents an hour, the predominant rate for wood and steel freight car repairers today. If in the future it should be advanced about 5 per cent on a given road, or to 66 cents, the columnar headings on these reports with respect to applied piecework cost should be changed to represent 95 per cent of those shown so as to perpetuate the unit comparison, as 5 per cent more money then spent on the unit would not indicate 5 per cent more work than formerly.

The basis of the output unit comparison shown in lines *A* to *E* is nothing more than a constructed unvarying piecework hour, properly equated to maintain comparisons. This piecework hour is the proper unit of output. It is involved, or becomes a matter of record, only when work or output is achieved. It is not and should not be the straight piecework hour.

When consolidating for a division or road the reports as outlined, it may occasionally happen that piecework schedules of shop *A* are 10 per cent higher than point *B*. If so the point *B* applied piecework cost (line *A*) should be divided by 110 per cent to effect proper comparison of output units per man hour at both points.

The use of this form modified to suit the conditions on each road would develop the following facts:

First—It would provide an accurate basis of comparison one month with another at the same shop, and one shop with another in same month, irrespective of the nature of the work, size of plant, force, etc.

Second—It would effect an accurate comparison for years, irrespective of changes in the character of repairs.

Third—It would indicate whether heavy repairs in general were increasing at a given point.

Fourth—It would eliminate the present tendency to assume that mismanagement exists when there is a decrease in the number of cars receiving heavy repairs, with perhaps an increase in the payroll, during any current months as compared with the previous month, when as a matter of fact the heavy cars in the current month received more extensive repairs.

Fifth—It would perpetuate existing comparisons, as it merely amplifies, without discarding, the present segregations as to light, medium and heavy repairs.

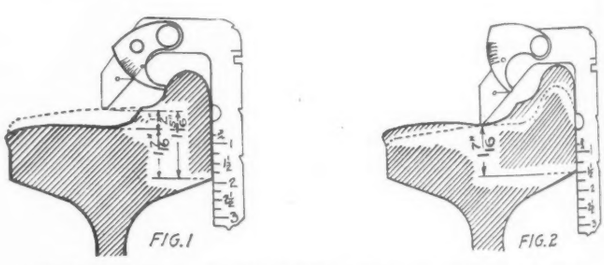
A New Use for the A. R. A. Steel Wheel Gage

By A. B. Crandall

Chief Mechanical Draftsman, Akron, Canton & Youngstown, Akron, O.

THE new A. R. A. steel wheel gage is designed to give data in connection with the restoration of a normal tread contour to worn steel wheels. This data is required for A. R. A. billing purposes and for the machining of the tread. The application of the gage to sharp flanges has been fully covered in previous articles.*

This gage may be used to give the same information in the case of the double flange. An inspection of the illustrations suggests a method for this case. It is first desired to ascertain the amount of metal which will have to be removed to restore the normal tread. To determine this the adjustable finger of the gage is placed at zero and, when so adjusted, should fit



Method of Using the Steel Wheel Gage on Double Flanges

a normal tread. The adjustable finger should touch the flange, and the tread finger should touch the tread. Hence, if applied to a worn double flange tread, as shown in Fig. 1, the long graduated finger shows the thickness of the tread before turning.

The adjustable finger is then swung out of the way, and the gage is reapplied, as shown in Fig. 2. The long graduated finger now shows the thickness of the tread after turning. Hence the difference in the readings is the amount of metal which must be removed to restore the normal tread contour on the wheel.

For example, by placing the adjustable finger at zero, and applying as shown in Fig. 1, the graduated finger shows a tread thickness before turning, of 1 15/16 in. The adjust-

* See the *Railway Mechanical Engineer* for March, 1924, page 164, and April, 1924, page 224.

able finger is then swung out of the way and the gage applied as in Fig. 2. The reading on the graduated finger is now 1 7/16 in. The metal which must be removed to restore normal contour is the difference between the two or ½ in.

By this method it is possible to procure all necessary information for A. R. A. billing and for machining the tread. The basis for the above solution is that the flange surface of the worn tread is the original perfect flange and has not been subjected to wear. This is the actual case. The errors in truck alinement or other causes which bring about a double flange create a condition wherein the rail does not come in contact with the flange, but wears a groove some distance removed from the flange. Hence an inspection of a double flange shows tool marks on the flange surface, indicating that on such a type of worn tread the flange does not suffer wear, but retains its original true shape.

Recent Decisions of the Arbitration Committee

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Rules Governing Prices Have Changed Before Repairs Are Completed

In November, 1920, the Terminal Railroad Association of St. Louis rendered a bill amounting to $841.48, vs. the Northern Pacific, for the cost of repairs to Northern Pacific car No. 100285. A letter was addressed to the car owners, dated September 2, 1920, accompanied by an inspection certificate, the first and main sheet of which bore no date, the second and third sheets of which bore date of August 24, 1920, with request that disposition be furnished under the provisions of Rule 120. Disposition was furnished by the car owner in a letter dated September 13, 1920, but the companies were not able to agree as to the proper estimate of the amount of repairs on the car. The Terminal Association claimed that the estimate of the cost of labor and material should be based on the date that the repairs to the car had been dated. The Northen Pacific contended that the cost should be based on the date that was shown on the first sheet of the second certificate.

The Arbitration Committee decided that in rendering a bill the prices in effect on the date repairs were completed should govern notwithstanding the estimated cost of repairs, as shown in the inspection certificate, was based on prices in effect on the date of inspection for reporting car under Rule 120. The car owner should properly assume the increased cost of repairs due to the increase in prices, with the $50.00 margin provided in Rule 120.—*Case No.* 1294, *Terminal Railroad Association of St. Louis vs. Northern Pacific.*

Overlapping Labor Charges

Under date of March 14, 1923, the Missouri, Kansas & Texas received from the Peerless Transit Line a bill amounting to $584.58, covering a number of repairs made to PTLX tank cars on authority of defect cards.

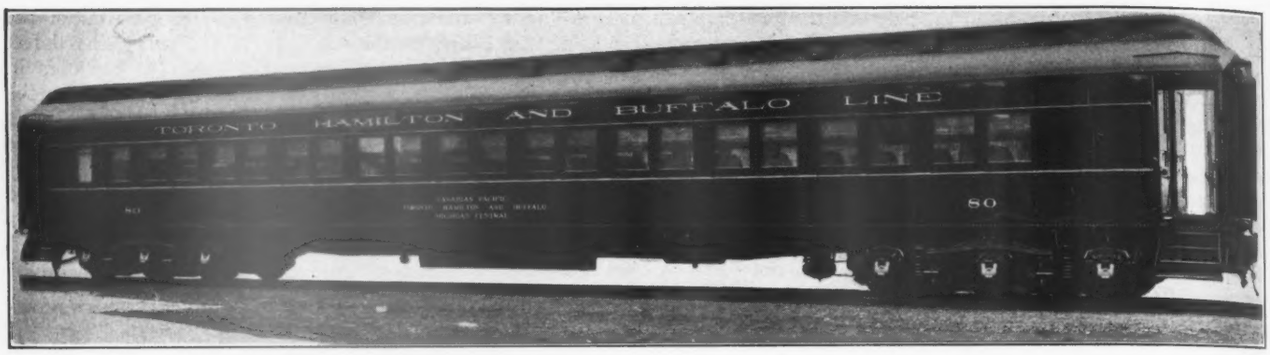
Upon making a check of this bill, exceptions were taken to charges for removing the brake shaft and uncoupling levers and replacing in connection with the renewal of the end running board on the "B" end of the car. The defect card, together with the billing repair cards on the cars in question were returned to the Peerless Transit Line with the request that it reduce the charges to conform with item 278-B of Rule 107, which provides for a charge of 11c. per foot for renewing the running board on tank cars, including all bolts, fitting and boring. The Peerless Transit Line refused to reduce its charge and the Missouri, Kansas & Texas contended that the labor for replacing the brake staff and release lever was not covered by the item referred to of Rule 107.

The Missouri, Kansas & Texas claimed that no charge should have been made for the removal and replacing of the brake shaft and uncoupling levers as this was necessary to apply the running board on either the A or B ends of the car. They, therefore, charged that such items were incorrect. The Peerless Transit Line contended that under the same rule, item 76 made it permissible to render the charge of 1 1/10 hours for the replacing of the brake staff, and in item 254, it allowed 8/10 of an hour for replacing the release lever, making a total charge of $2.09 for replacing the brake staff and release lever.

It was decided by the Arbitration Committee that no additional labor may be charged for removing and replacing the brake shaft and uncoupling lever on account of the renewal of the end running board on the same end. Specified average charge of 11c. per foot for renewing the running board on tank cars governs as per item 278-B of Rule 107.—*Case No.* 1293, *Missouri, Kansas & Texas vs. Peerless Transit Line.*

Incomplete Evidence Furnished to Support Claim for Wrong Repairs

On September 11, 1920, the Baltimore & Ohio made heavy repairs to the B end of Louisiana & Arkansas box car 2559. A bill of $663.33 was rendered by the Baltimore & Ohio to the car owners. The Louisiana & Arkansas questioned some of the charges contained in the repairing line's bill and asked them to cancel charges amounting to $22.67. The repair items questioned were for patching the body bolster. The owners claimed that the bolsters on this car were of cast steel construction and therefore the charge for patching was an error. The repairing line, however, refused to cancel these charges on the ground that the original record of the car showed that the bolster was of pressed steel construction and it contended that the Louisiana & Arkansas should secure a joint evidence certificate according to Rule 12. The car owners claimed that cast steeel body bolsters were standard to this equipment and that it had no record of cast steel body bolsters ever being applied to this car previous to the time of the Baltimore & Ohio's bill for repairs. It further contended that the patching of cast steel bolsters was considered temporary repairs. General repairs were made to this car on July 2, 1921 and new body bolsters were applied. However, a joint evidence was not obtained at this time as the car owners considered the work done by the Baltimore & Ohio to be a case of temporary repairs and not one of wrong repairs. The repairing line, however, claimed that the owner should have obtained evidence at the time general repairs were made and as its records show that the car was equipped with pressed steel body bolsters the matter was referred to the Arbitration Committee which rendered the following decision: "The car owner has not furnished the necessary evidence to establish a claim of wrong repairs. Therefore, the position of the Baltimore & Ohio is sustained. —*Case No.* 1297, *Louisville & Arkansas vs. Baltimore & Ohio.*



The Coaches Can Seat Eighty-seven People

New Passenger Equipment for the T. H. & B.

Coaches and Baggage Cars Are of Steel Construction and Are Equipped with Clasp Brakes

THE Canadian Car & Foundry Company, Limited, Montreal, Que., recently delivered to the Toronto, Hamilton & Buffalo 26 all-steel cars to be used in its passenger service between Toronto, Ont., and Buffalo, N. Y. This equipment consists of 10 first-class coaches, 10 smoking coaches and 6 baggage cars. The smoking coaches are of the same general construction and finish as the first-class coaches, with the exception of the upholstery of the seats. The first-class coaches are upholstered in plush, while the smoking coach seats are upholstered in leather. These cars have a seating capacity of 87 in the main room. Both the men's and women's saloons are

Movable Floor Racks Are Provided at the End Sections

equipped with single bowl wash basins and Duner exposed type hoppers. Water coolers are provided at each end of the car. The main room has basket racks for holding luggage and the smoking cars are also provided with match box holders and match strikers at every seat.

Underframe Construction

The center sills are of the built-up fish belly type and have 5/16 in. web plates. The web plates are reinforced with one 6 in. by 4 in. by 5/8 in. top angle and two 3 in. by 3 in. by 3/8 in. bottom angle stiffeners. A 1/2 in. cover plate is connected to the side sills by 5/16 in. pressed web plates, reinforced with 3 in. by 2 1/2 in. by 5/16 in. angles. The side sills are made of 5 in. 11.6 lb. wrought steel Z-bars.

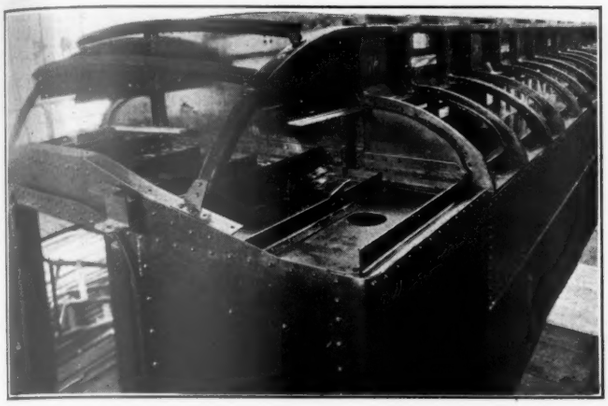
General Dimensions

The total length over the buffers of the passenger and smoking coaches is 84 ft. 4 1/2 in. The length over the end

The Side Walls of the Passenger Coaches Are Well Insulated

sills is 73 ft. 6 in., while the length inside of the main room is 72 ft. 10 in. The distance between truck centers is 57 ft. 6 in., and the trucks have a wheel base of 11 ft. The outside width over the eaves is 10 ft. 2 3/16 in., and the width

over the side sills is 9 ft. 9⅝ in. The inside width between the side posts is 9 ft. 1 in., which permits an inside clearance of 8 ft. 11 in. The height from the top of the rail to the



View Showing the Roof Construction

top of the roof is 14 ft. 1½ in., and the height to the top of the platform of the passenger coach is 4 ft. 2 7/16 in. The empty weight of these cars is 150,600 lb.

The Ceiling Lights Are Staggered to Equalize the Illumination

The baggage cars are shorter than the passenger equipment, having a length over the buffers of 77 ft. 3½ in. and a length over the end sills of 73 ft. 6 in. The inside length of these cars is 72 ft. 10 in., which allows a commodious space for handling baggage. The distance between truck centers is 52 ft. 5 in. The same type of truck and brake equipment is used on both the baggage and passenger cars. The outside width over the eaves and the width between the sides posts is the same as that of the passenger cars. This design of superstructure permits an inside clearance of 9 ft. ⅜ in. in the baggage car. The height from the rail to the top of the floor is 4 ft. 6⅜ in. The empty weight is 146,000 lb.

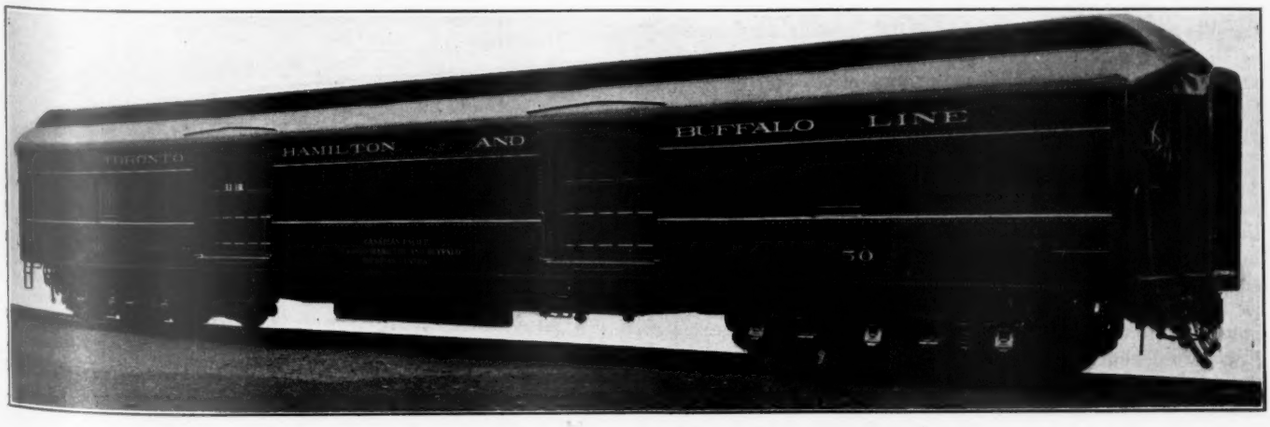
All of the cars are provided with the Westinghouse UC-1-18 equipment and clasp brake. Miner friction draft gear and buffers are used. The trucks are the Commonwealth

Interior View of a Baggage Car Before the Roof and Insulation Is Applied

cast steel design and have 36¼ in. wheels with cast steel centers and 5 in. by 9 in. A. R. A. axle journals.

Construction and Insulation of the Walls and Floors

The floor is made of 1/16-in. steel plate. It is insulated at the center of the car and at the doorways by three-ply salamander, a 3 in. air space; bottom wood floor 3/16 in. in thickness; one layer of asbestos-asphaltum paper; 1/16 in. reeferite; one layer No. 14 asbestos-asphaltum paper, and a top wood floor 1 in. thick. The end flooring of the car is insulated by one course of three-ply salamander, a bottom floor 1 in. thick; one layer No. 50 asbestos-asphaltum paper; 1/16 in. reeferite; one layer No. 14 asbestos-asphaltum paper, a top wood floor 1 in. thick, and ¼ in. reeferite, with 1/16 in. of sand rolled into the surface. Movable floor racks



New Baggage Car Recently Built for the Toronto, Hamilton & Buffalo

are applied at the end section as is shown in one of the illustrations.

Wood Nailing Strips Are Bolted to the Steel Frame of the Roof

The walls are insulated by one course of one-ply salamander behind the head lining, two-ply salamander on the letter plate at the windows, and ½ in. Keystone hairfelt on the pilasters, ends and under the windows, together with one course of three-ply salamander. The interior is finished in figured African walnut. The roof is of all-wood construction resting on the steel framework, as is shown in one of the illustrations. It is covered with No. 6 white canvas embedded in white lead and is secured to the roof with copper tacks.

The Illumination and Heating System

The illumination is provided by an electric lighting system, manufactured by the Safety Car Heating & Lighting Company, which receives its current from a 3-kw., 30-volt axle generator and Edison storage batteries. In order to equalize the illumination, the bracket lamps in the main body of the car are staggered. The coaches are heated by the straight vapor system which is manufactured by the Vapor Car Heating Company.

Proceedings of the Air Brake Association

Report of the Papers and Discussions at the Thirty-First Annual Convention Held at Montreal

THE proceedings of the opening session of the Air Brake Association Convention, held at the Mount Royal Hotel, Montreal, Que., May 6, 7, 8 and 9, were published in the June issue of the *Railway Mechanical Engineer,* together with the paper and discussion on Freight Car Foundation Brake Design. Further proceedings of this convention are given herewith.

Report on Passenger Train Handling

The question of passenger trains being on time and smoothly handled is receiving much consideration because of competition. The public has been educated to expect high speed, safety and luxuries in the way of service that were not formerly demanded. As a result, they are critical if trains are delayed or are not handled smoothly. The influence these dissatisfied passengers have on others contemplating a trip cannot be discounted.

The fundamental cause of shocks to trains is a sudden change of slack, either in or out, and is produced by a rapid change of velocity between the various units comprising the train. Shocks are caused by starting quickly, taking slack harshly or restarting quickly after taking slack. The action of the brakes in changing the slack will be the most severe at low speeds. Therefore, make any brake application suit the speed, being careful to avoid heavy brake applications at low speed.

Co-ordinating the Throttle and Brake Valve

It is desirable to avoid a change in the position of the throttle and the use of the air brakes at the same time. This is important if the action of either will change the train slack in the same direction. Under such condition the effect would be intensified if both were used at the same time. Do not open the throttle until all brakes have had time to release. For slow speed stops, do not shut off and immediately apply the brakes. Either shut off gradually a few seconds previously, according to conditions, or apply the brakes to a proper degree and later reduce the throttle gradually until shut off.

A few seconds of time allowance for the effect of the action of the throttle and another few seconds between the initial and subsequent reductions is of such vital importance in the operation of long passenger trains that the time element can-

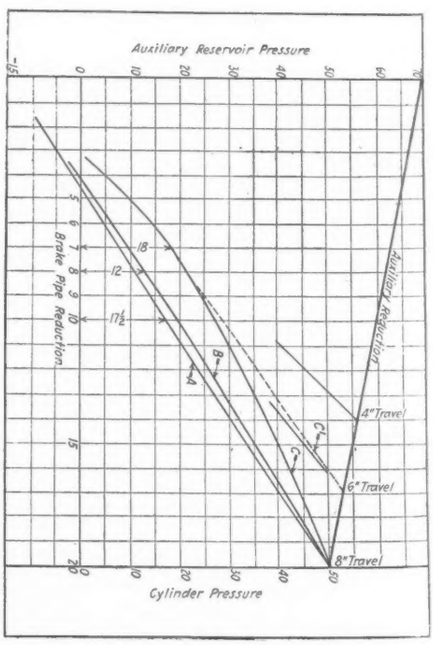


Fig. 1—Chart Showing the Relation of Cylinder Pressure Per Pound to Brake Pipe Reduction

not be ignored, more especially on long trains and slow speed stops.

Sleepers and observation cars at the rear ends of passenger trains, braked at 75 per cent on 50 lb. cylinder pressure (equivalent to 90 per cent on 60 lb.) seldom lose much of their maximum retarding effect because they are not loaded

cars. Day coaches are semi-load cars, while the baggage, mail and express cars just ahead, although braking at 75 per cent when empty, are usually loaded so that the average retarding force is around 45 to 55 per cent of the total load. Forward of these is the locomotive varying from 35 to 41 per cent in brake force, in proportion to the working load. It will be seen that the modern passenger train running forward will stretch after all brakes are applied and stretch harder as the brake force is increased. The opposite is true of a back-

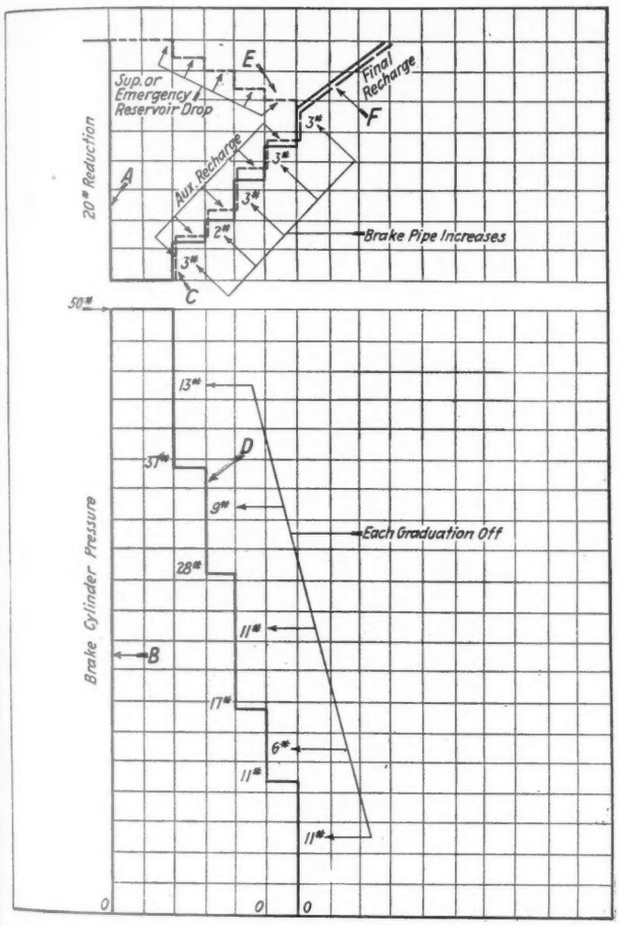


Fig. 2—Chart Illustrating the Action of the Pressures on an Individual Release Brake

ing train; after all brakes are applied the train bunches and remains so until the brakes are released.

The brakes nearest to the point in the train where the reduction is started are the first to begin to apply. With a train running forward and the brake pipe reduction started from the head end, the tendency is to start bunching. After the brake pipe reduction is effective on the rear, the train stretches again. If the train is backing and the back-up men are controlling, the rear brakes start to apply first which tends to bunch the train, beginning at the rear. Therefore, a very moderate use of steam by the engineer to keep the slack in until he feels the brake begin to hold, will materially assist in producing a smooth stop. This is equally true if the engineman stops the backing train. Do not shut off entirely until the reduction has been sufficient to have all brakes applied throughout the train. Keeping the locomotive brake released at this time assists materially.

Slack Adjustment

The action of the automatic brake is based on piston travel. Very few actually realize what this means. Many cases of rough handling can be traced to short piston travel, leading to inability to develop a low cylinder pressure for a reduction of six to seven pounds. It is true that many of the older forms of passenger foundation brakes have a great deal of deflection, which causes the piston travel to elongate excessively as the cylinder pressure is increased, primarily owing to high total leverage and weak members. Added to this is an increase of 1½ in. to 2½ in. difference between full standing and running travel due to trucks settling.

The modern clasp brake has about ½ in. difference between standing and running piston travel, very little deflection and longer piston travel for the initial reduction, with a corresponding lower pressure at this moment. Clasp brake cars should be adjusted to not less than 7½ in. standing travel with a full service brake application. Roads doing this are getting very good results. Some roads are adjusting the other types of foundation brakes at 7½ in. standing travel also, thereby obtaining smoother brake operation. One property which has only the low hung, single shoe, six wheel trucks, makes it a practice to start the trains with 7½ in. standing travel and let them out at one point on the line

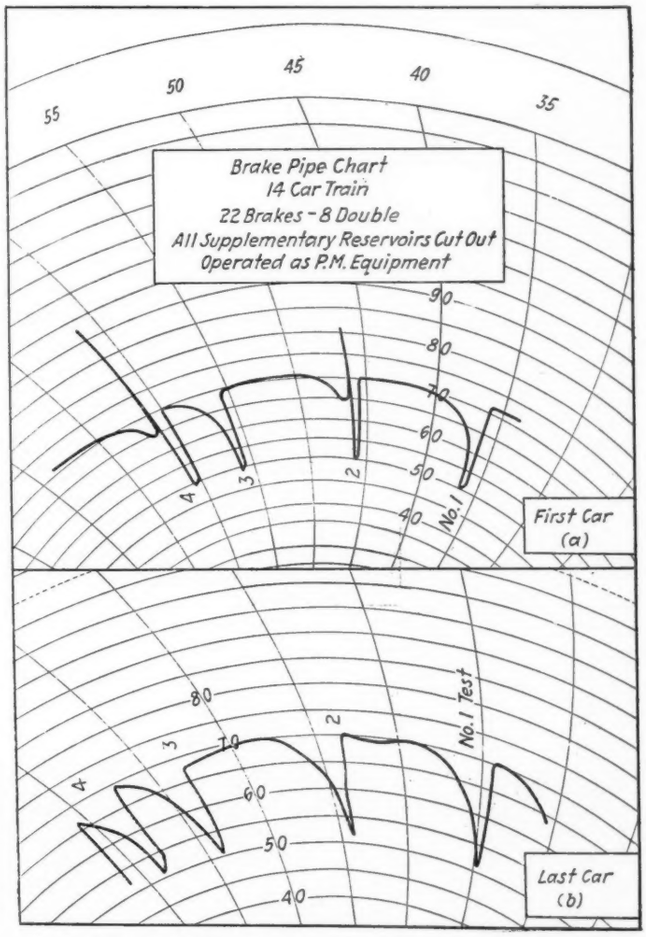


Fig. 3—Section of Recorder Chart Taken From the First and Last Cars

on coast trains, about half way between the extreme terminals, thus obtaining better results.

Fig. 1 is illustrative of what is desired and what frequently occurs. Line *A* represents the desired cylinder pressure per pound of brake pipe reduction. Line *B* practically represents what occurs with a modern clasp brake, while lines *C* and *C'* show what happens on cars with the least desirable foundation brake conditions. With such brake adjustment

as shown on line *C*, long trains cannot be smoothly handled by the engineman.

Graduated Release

There are two types of graduated release brakes in use for steam road service, known as LN and UC. When an experienced air brake man thinks over the flexibility of the straight air brake, with its ability to be graduated off to produce less deceleration, he does not wonder that graduated release was incorporated in the automatic brake.

The one application, graduated-off stop, requires less distance than the two application stop, and also less time. It assists in making schedule time. Smoother stops are accomplished because the train slack adjustment is usually made only once and at the beginning of the stop while the speed is highest, and because the brakes are coming off near the end of the stop. The engineman is enabled to correct his judgment of speed and distance after he has used the brakes sufficiently to be sure he is inside the stopping distance by enabling him to graduate off to place the train at the desired location. This avoids an entire release and reapplication, which, under some conditions of speed and distance to final stopping point, causes rough handling.

Where the brakes are graduated off properly, long trains are more easily started because the train stretch is reduced and draft gears released to nominal position while the train is moving. The ability is present more surely to move all triple valve or equalizing portions of brake equipments to release position, causing less stuck brakes because graduated release, quick recharging brakes require an increase of brake pipe pressure only. This increase can be made quite rapidly.

The auxiliary reservoir recharge is taken care of by the air pressure from the supplementary or emergency reservoirs until the brake is entirely released. This avoids a drain on the brake pipe pressure while the release is being accomplished. It also permits several reapplications of the brake in quick succession without materially depleting the system. After the quick recharge feature has been entirely absorbed, the final finish of the recharge of all reservoirs comes from the locomotive through the brake pipe.

Individual Graduated Release Brake

Fig. 2 illustrates the action of the pressures as caught by gages on an individual graduated release brake. Line *A* represents the brake pipe reduction. Line *B* illustrates the resultant brake cylinder pressure. Lines *C*, solid and dotted, show the increases of brake pipe and auxiliary pressures while graduating off. Line *D* indicates the graduated release of cylinder pressure. Line *E* corresponds to the supplementary or emergency reservoir drop while it is recharging the auxiliary reservoir. Lines at *F* represent the final recharge of reservoirs from the brake pipe.

Figs. 3 and 4 are sections of two recorder charts taken from the forward and rear portions of a 14-car, LN equipped

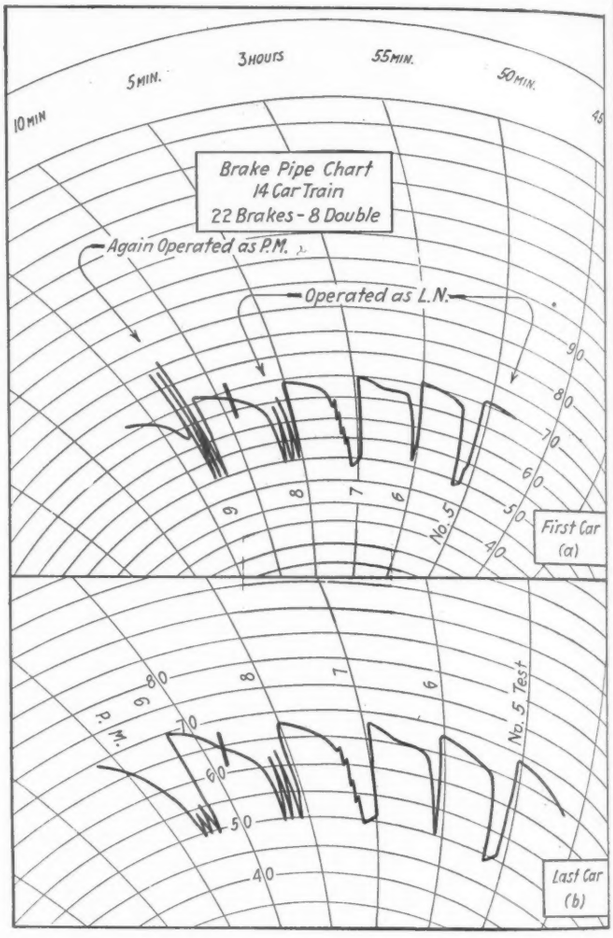


Fig. 4—Action of the Pressures on an Individual Release Brake with the Supplementaries Cut In

train with 22 brakes; 8 cars having double brakes. All equipment was first operated as PM, the supplementaries being cut out (see Fig. 3). Tests Nos. 1 and 3 are running position releases. Tests Nos. 2 and 4 show release position used for a limited length of time. Observe the slow rise of

The Air Brake Association at the Thirty-First Annual

brake pipe pressure at the rear end of the train on account of the drain by the 22 auxiliary reservoirs.

A Comparison

Compare these with the events on Fig. 4 in which the supplementaries were cut in on the first four of these tests. Test No. 5 shows running position release. Test No. 6 shows release position, then running position the balance of the time. Test No. 7 shows running position and lap step-ups. Test No. 8 shows running position, three releases and three reapplications in quick succession. Note the rapid and nearly equal rise of the rear and forward brake pipe pressures on each release. Test No. 9 shows supplementaries cut out again and three similar releases and reapplications. This time the brake valve was used in release position only until the forward brake piston returned into the cylinder, when a reapplication was made. Note how impossible it was to drive the air through the brake pipe rapidly owing to absorption by the numerous auxiliary reservoirs.

Usually about 50 sec. or less are consumed in making the stop, while not longer than 15 to 20 sec. of this are used while the brakes are being graduated off. The average time for the long train two-application stop requires from 60 to 75 sec., if done as intended.

Two positions of the brake valve are used to increase the brake pipe pressure while graduating off, the release position and the running position. The release position furnishes a rapid rise, generally used for the first graduations off on long trains, for recharging on grades or for releasing the last graduation where it is desired to reduce the cylinder pressure quickly. The running position supplies a smaller, but effective opening for subsequent graduation on long trains and all graduations off on shorter trains.

75 Per Cent Sufficient

Frequently graduated release trains contain a few PM equipment brakes. It has been shown that if three-fourths of the train is graduated release equipment, good graduated release operation can be performed. When PM equipment cars are in graduated release trains, they release entirely when the first graduation off is made. A good graduated release engineer will pay no attention to a few PM cars. He usually governs himself by way the train decelerates after the first graduation off.

Retaining valves should be used on graduated release trains, the same as PM equipment trains, whenever the brakes cannot be recharged to 80 lb. When operating with retaining valves, be sure that the application is sufficient to insure a release, so that the train is retarded by retaining valves and not by sticking brakes. Graduated release must not be used when retaining valves are in operation. Where retaining valves are not cut in and graduated release is depended on, not more than one release graduation should be used between complete recharges. Use release position of the brake valve when recharging and follow with a kick-off.

Where trouble is experienced with brakes sticking on graduated release equipment after locomotives are changed, or switch engines are used to change the make-up of train, this is primarily caused by a difference of brake pipe pressure adjustment on the different locomotives. The locomotive not experiencing this trouble has the higher pressure, possibly too much, while the one having the trouble has the lower pressure, possibly below the authorized amount.

A good practice to follow when changing engines is to leave the brakes applied by the delivering engine after stopping. The receiving engine releases them and when the test of the brakes is made, it will eliminate any trouble due to a slight difference of air pressures between the two locomotives.

All road engines should have the regulators set close to a uniform pressure, and all switch engines should have available air pressure adjustment so that when handling a train the pressure can be raised to the amount authorized for that train.

The report was signed by James Elder, C. M. & St. P.; W. J. Devine, C. & N. W., and L. M. Carlton, Westinghouse Air Brake Company.

Discussion

The discussion of this paper dealt largely with the relative merits of the graduated and direct release. It was brought out that many engineers liked the graduated release better on account of being able to make smoother stops with greater ease than with the direct release. Some of the roads handling heavy passenger trains use the graduated release on all trains equipped with the PC equipment and require the use of direct release on trains equipped with the LN equipment. On account of the large number of roads having to handle Pullman equipment in the same train with company owned cars the fact was brought out that the Pullman Company recommended the use of the universal equipment on all of its cars, as the UC type is designed to operate with the PC, LN, or with any other type of brake equipment.

The discussion brought out that there are two principal factors entering into the decision as to what release should be adopted. One is the operating conditions, which must be given careful consideration; the other is the amount of instruction that can be given to enginemen. The effect of climatic conditions, such as are encountered by the roads in Canada, as well as the character of the terrain through which the roads run, have a vital effect on brake operation, and the roads are required to adopt equipment that would permit

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the greatest factor of safety and reduce wear on the brake shoes and slide flat wheels to the minimum.

The question of the use of the retainer was brought up by the president and it seemed to be the opinion of the convention that the retainer should not be used with the graduated release. One member stated that his road left the use of the retainer up to the judgment of the engineman and conductor and after a short time it was discovered that its use had gradually died out. Various opinions were expressed as to the use of the graduated release with the PM and LN equipment. Some members reported that their roads used the graduated release with both types and were getting very good results.

Brake Pipe Leakage

During the year the committee which investigated the subject of Air Consumption of Locomotive Auxiliary Devices, on which it rendered its final report at the 1921 convention, was assigned the subject of brake pipe leakage. The assignment was made too late to permit an investigation this year, but the committee reported that it has formulated a program for the ensuing year for the purpose of developing data to support definite conclusions and recommendations on the following questions:

(1) What is the average leakage rate for trains in current service?

(2) What is the ratio between the amount of compressed air used for braking and the amount of air wasted in maintaining unnecessary leaks?

(3) What degree of leakage can be tolerated without serious interference with train operation?

(4) What is the unit cost of brake system leakage?

(5) What are the most efficient methods of inspecting and testing and repairing brake system leaks?

(6) What degree of maintenance expense is justified in the light of existing conditions?

The members of the Committee are C. H. Weaver, New York Central, chairman; C. B. Miles, Cleveland, Cincinnati, Chicago & St. Louis; W. W. White, Michigan Central, and R. E. Miller, representing the Westinghouse Air Brake Company.

Discussion

The discussion was opened by a member asking the question, "Where does the greatest percentage of pipe leakage take place?" In the attempt to settle this question various points on the train lines were mentioned, of which the hose and coupling received the most frequent comment. President Wood expressed the opinion that the committee should investigate the possibility of increasing compressor capacity sufficiently to offset leakage from 5 lb. to 8 lb. per min. Some of the members maintained, however, that increased compressor capacity meant increased carelessness on the part of many inspectors and no advantage would be obtained. It was generally agreed that any leakage amounting to 8 lb. or over should be reduced before the train left its initial terminal.

R. M. Long (P. & L. E.) said that the place to stop leaks was on the rip track. There was no economy in waiting for a train to be made up before testing, for if considerable leakage was discovered it meant a delay. The utilization of the Westinghouse single car testing device was recommended as an effective means for reducing leakage in air brake piping.

Various means for detecting brake pipe leakage were discussed, such as using the 95-car rack and making a 10-lb. reduction from a 70-lb. pressure. The advantages to be obtained by testing the train line with the train stretched and the possibility of increased leakage due to drawbar action while on the road were mentioned.

Attention was also called to the fact that the bad practice of pulling hose couplings was quite common and that many car men persisted in the practice of turning gaskets. A strain of from 1,200 to 1,400 lb. is exerted every time a hose is pulled apart at the coupling.

It was recommended that the work of this committee should be continued and that its report should also take into consideration the maintenance of hose, as it was an important factor in leakage.

Interesting Employees in the Study of Air Brakes

By J. P. Stewart

We know of very few subjects on which knowledge can be as extensively and easily obtained, and at as small a cost, as knowledge of the air brake equipment. Pamphlets that are interesting and attractive are published by the manufacturing companies and gladly sent to applicants, postage paid, for the mere asking. Pages in the different railway and union magazines are devoted to explaining and picturing the features of the equipment. So it is possible for any man to build up a nice technical library on this subject with practically no cost. For a very modest price the splendid books which the Air Brake Association publishes are to be had. Then the railways and other companies place means of instruction and education at the command of the men.

But in spite of all these opportunities we have to admit that there is a failure somewhere. As a result the average railway man begins to grow restless as soon as the subject of instruction is broached. And I fear this is a condition that will continue to exist until someone makes an instruction class appear as attractive as a musical comedy or a band concert.

Instruction cars and instruction rooms are good. But there are those who attend just as a matter of duty and who at the close of a class are not able to tell what was talked about. There are many like a fireman I met at a small terminal. He came up to the instruction car after closing time and requested permission to register, saying, "I want to get my name on the register so the trainmaster will not make me follow the car. But I have been in the car once, a year ago, and know everything in there." Now this fireman did not know everything in there. In fact, I know that he could not as much as test a feed valve. I fear that the average man wants just enough instruction to get by. As a result instruction cars and instruction rooms lose their hold as soon as the newness wears off. But if properly backed up we believe they can accomplish great good.

This committee would like to recommend that every air brake instructor, road foreman of engines, and every official secure copies of the instruction pamphlets issued by the Westinghouse Air Brake Company, and read the preface entitled "How to Study the Air Brake."

Arrange for places where the men can loaf and talk air brake, or settle arguments. Encourage arguments. By that way we get the other fellow's opinions and ideas. Have charts and books and parts of the equipment where the men can have access to them just by themselves. If possible have an office or room at each terminal where the men can get the information necessary to decide their arguments, and where they will like to loaf. Then surround them with air brake material, literature and charts. Have the men understand that this is their room. If you haven't any clubroom or recreation room at that terminal, have some card tables and checker boards in your instruction room. Make it attractive.

Talk to the new firemen. Have them understand that before they become enginemen they must understand the air brake equipment. And have them understand that the only method is to start studying when they start firing. Then have first, second and third year examinations of firemen. In these examinations have some air brake questions suitable for a man with their length of service, and insist on the men passing these examinations. Then have a good, stiff examination when the fireman comes up for promotion.

It should be made possible for the men to keep posted on all new devices. Make it interesting for them to talk about these devices. And then try and have your company require the men operating and maintaining the air brake equipment to take an examination at least every three years. Men maintaining and operating air brake equipment are in a position such that a failure on their part, or a misunderstanding of the proper method of doing their work, may result in great loss. The man who is willing and trying to learn and advance, the examination will be welcome. For the man who just wants to get by, the examination is a necessity.

Never fail to take time to answer questions, regardless of how small or how foolish they may be. If some one asks a question that is new or has you guessing, play fair and tell him that he shows good sense in getting that deeply into the subject, and that you will have to study it out before answering. Don't try to bluff it out by getting technical; the more you talk, the worse you will be in. All the men in the class will enjoy your embarrassment, and also lose confidence in your teachings.

If possible, form air brake clubs during the winter months, and have monthly or semi-monthly meetings. Have the men from two or three terminals at each meeting, and create rivalry between the terminals as to who can produce the best paper. To do this it is necessary to have the transportation department with you. This can be done by having the transportation officials as members of your club.

Discussion

A brief discussion of Mr. Stewart's paper brought out the necessity of getting something new to keep the men's interest aroused in their work. The instruction car should be made attractive so as to make the men want to use it. The idea of arousing a competitive spirit among the men by choosing some man having a high standing and using him as an example was also suggested as getting good results.

The Triple Valve Test Rack Operator

By the North-West Air Brake Club

The importance of picking the man cannot be overestimated and is too often done hurriedly, with little, if any, consideration as to the fact that he should be able to read and write English, be properly inquisitive, able to listen when others are talking, have keen eyesight and good physical health.

At a cleaning point where no heavy triple valve repairs are made, merely cleaning, lubricating and light repairs, the candidate should have had at least two months' experience on brake cylinder cleaning and triple valve changing and the same period on triple valve cleaning. At a point where heavy repairs are made, the foregoing experience should be supplemented by enough work in heavy repairing to make him competent in this. Obviously, this latter experience should be obtained under the supervision of a competent repairman.

Where seniority must govern more or less in promotion, it is all the more important to exercise care in the selection of men for the work of brake cylinder cleaning.

Experience in brake cleaning, particularly that of cylinder work, is important, as it is impossible, even with the best quality of triple valve work, to have good brakes when brake cylinders are slighted. In the last analysis, the efficiency of a brake depends on the brake cylinder being in perfect condition. For this reason, although properly not under the subject of the paper, we wish to warn against the too common attitude that anybody can clean brake cylinders, when assigning men to such work. Our air brake mechanics should come from among these men. The man who satisfactorily meets the above requirements will ordinarily give little trouble to the general air brake inspector in the more advanced work to follow.

Relative to starting the instruction of a man on the test rack, it should be borne in mind that a little, well learned is of greater benefit than that which is poorly learned. Consequently, the more important tests, such as charging and testing the emergency piston and ring, should be the first in which he should be drilled. As a man becomes acquainted with the construction of the rack and the purpose of the tests, the individual test will no longer be a matter of memory, but a reasoning from cause to effect, with the object a perfect operating valve.

Along with this part of the work, the operator should be instructed on the care of the rack. Definite periods, not less than once each week, should be set for this work, at which time all operating parts should be thoroughly cleaned and lubricated and the rack tested for leaks. Satisfactory life and operation of the rack depends on this systematic care. Too often a poorly maintained rack results in poor as well as unnecessary work being done.

As few men picked for triple valve work have had special mechanical training, care should be taken not to add repair work, such as the slide valve and ring, too rapidly. It is an easy matter to bewilder and discourage a man by unloading the more accurate work on him before he is ready. The instructor should do some of the heavy repair work before suggesting that the student try his hand with a file, scraper or lapping plate.

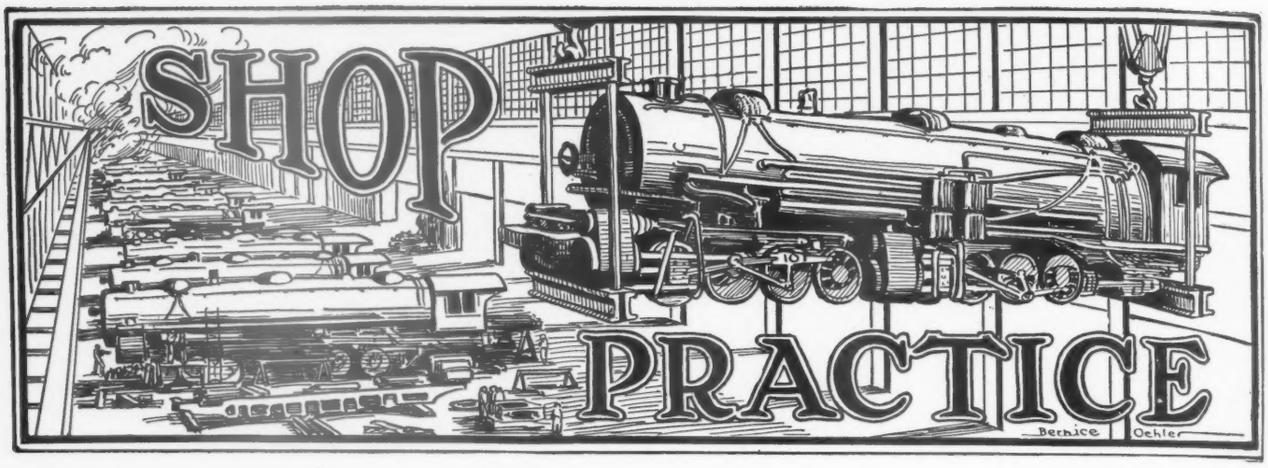
The value of such a man should hardly have to be pointed out in detail when the importance of correct brake operation is considered. First, in train safety; second, compliance with the Federal laws; and third, avoidance of train delays and damage incident to break-in-twos and stuck brakes. Then, there is the keeping down of the cost of the cleaning and repairs to triple valves. A competent rack operator will see that the character of work done on valves coming to him for testing is such as will reduce the rejections, with repetitions of such work, to the minimum possible.

Discussion

Considerable comment was made relative to the question of seniority, which seemed to conflict with the selection of an efficient test rack operator. It was generally agreed, however, that it was up to the air brake supervisor to see that the test rack operator receive the proper education. It was considered that one man with a 2-T rack should be able to test as high as 50 to 60 triple valves in an 8-hour day. There was also considerable discussion as to the knowledge that should be required of a test rack operator and that his pay should be increased as he does better and more efficient work on the test rack.

Other Papers

A report was also made by the Committee on Recommended Practice by the committee appointed to investigate the condemning limits of A. R. A. standard triple valves. It was decided to hold the last report over until next year in order to give the committee an opportunity to make further investigation.

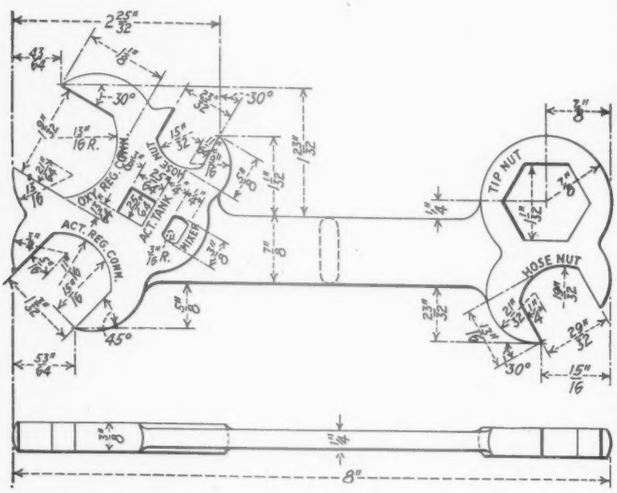


Welding Equipment in a Railroad Shop

Modern Tools Should Be Provided So That the Operator May Perform More Accurate and Efficient Work

By James S. Heaton
Welding Supervisor, Wabash, Decatur, Ill.

WELDING, as it is practiced today, is one of the most important processes in the railroad shop. To perform welding successfully, in any shop, the equipment should be of modern design and up to date for all requirements. Therefore, great care should be exercised in the selection of equipment, by purchasing only those tools which are best adapted for certain shop operating conditions. Modern tools have the advantage of enabling the operator to complete a more accurate job than it is possible to do with obsolete



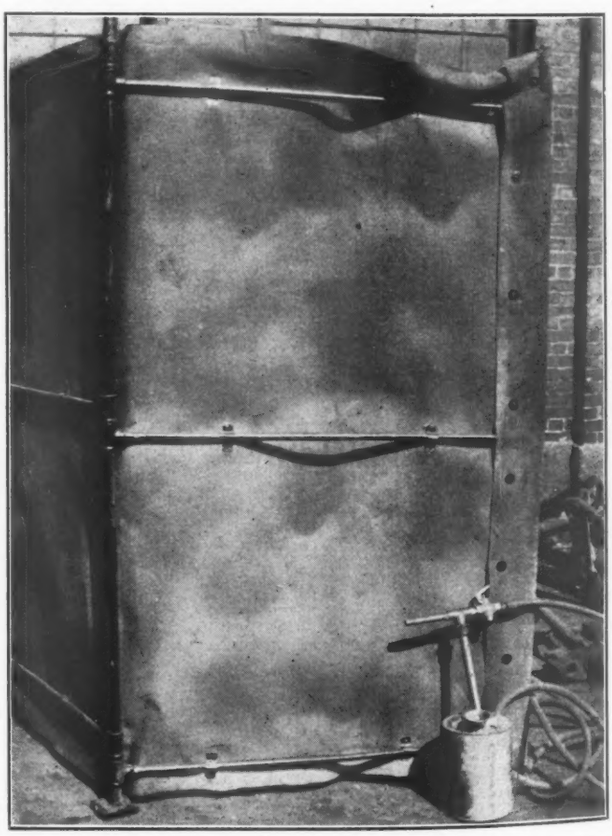
Combination Wrench That Can Be Used on All Connections of Welding Equipment

equipment. In order to keep locomotives and rolling stock on the road, accuracy must be the objective of all operators.

A careful study should be made relative to the layout and general arrangement of the shop, before purchasing welding equipment. Machines should be placed to facilitate the handling of material so as to reduce trucking, eliminate extra handling, waiting for cranes or interference with other work.

Acetylene Equipment

The equipment necessary for acetylene welding and cutting is shown in Fig. 1. It consists of two regulators, one for oxygen and one for acetylene; sufficient hose to connect the



Screen Used to Protect Machinery and Workmen from a Sand-blast

regulators and the torches,—of which there are two, one for welding and one for cutting,—a gas lighter, a pair of goggles and a combination wrench.

This equipment is mounted on a four-wheel truck equipped with ball bearings. On the bottom of the truck is a sheet

Fig. 1.—Portable Acetylene Equipment Used on the Wabash

of rubber two inches thick for the drums to stand on. The rubber is intended to absorb the shocks to which the drums are subjected while being transported around the shop.

The welding torch shown in Fig. 1 is manufactured by the

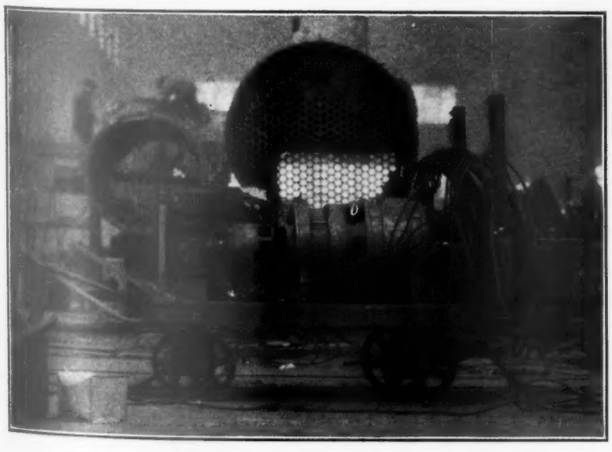


Fig. 2.—Portable Electric Arc Welding Equipment

Torchweld Equipment Company. It is made from solid bar stock and is equipped with a separate mixer for each size of tip. The cutting torch, manufactured by the Henderson-Willis Welding Company, is of the flat head design with the tip nut on the outside. The regulators are equipped with a three-piece steel diaphragm. This design tends to eliminate any buckling or breaking of the diaphragm due to the regulating screw being used while changing torches.

It is essential that the hose used for gases be of the best grade obtainable, for the service demands both ability to withstand wear and safety. The hose used on this road is made by the Gustin-Bacon Manufacturing Company and is a three-ply fabric, heavily rubber coated, designed to withstand hard usage. They are made in two colors in order to avoid the possibility of attaching the hose to the wrong connection. Red is used for acetylene and black for oxygen. As a further precaution the connections are also threaded right and left hand, right for oxygen and left for acetylene.

Goggles and Safety Equipment

The goggles, made by the Willson Goggle Company, are designed to afford the best ventilation and protection to the welder. This goggle has ventilating cups on each lens holder which afford the proper amount of air needed and is equipped with rubber tubing around the base which keeps out all sparks. The lenses are colored to keep out the rays injurious to the eyes.

To eliminate the practice of using matches to light the

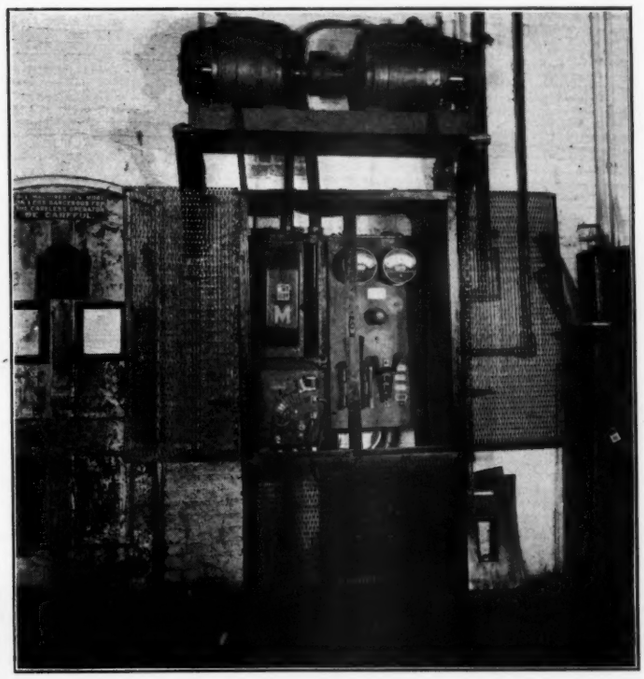


Fig. 3.—Stationary Type of Electric Arc Welding Equipment

torches, which is a waste of time, a gas lighter of the round file design, manufactured by the Safety Gas Lighter Company, is used. It is operated by a slight movement of the hand and is quite an improvement over the old method of lighting torches.

The wrench, shown in the drawing, is a combination of several wrenches in one. It can be used on all connections on the welding and cutting equipment. To prevent misplacing it the wrench is equipped with a small chain, four feet long. One end is welded to the wrench and the other is welded to the truck. A box of sand to be used in extinguishing fires started by sparks, and a bucket for cooling the torches, completes the equipment.

Electric Arc Welding

The principal advantage of arc welding is that it utilizes the heat between the electric arc and the material to be welded and confines the heat to a small space, thus reducing

the expansion or contraction. It is not necessary, however, to preheat wrought iron or steel when using the electric arc. Fig. 2 shows a machine manufactured by the Lincoln Electric Company. It is a direct current motor-generator type which is mounted on a truck with ball-bearing wheels. The open circuit voltage ranges from 40 to 100 volts. The reduction in voltage to that required by the arc is brought about by a series field and armature reaction. The arc may be drawn up to 5/8 in. and may be held for a short interval without breaking. This is accomplished by the use of a heavy inductive ballast or stabilizer and a complete laminated steel magnetic circuit. Fig. 3 shows a stationary type which may be placed on a wall or column and requires little floor space. The control equipment of both machines consists of an ammeter, voltmeter, field rheostat and circuit breaker which is mounted on a panel board.

The apparatus necessary for arc welding equipment consists of two 100-ft. cables, one for service and the other for a ground wire, an electrode holder which is connected to the service cable and a clamp, which is soldered to the ground wire and is used to make a tight connection to the material to be welded. A helmet equipped with a special glass designed to keep out the glare and protect the face from the ultra violet rays which arc welding produces, is also provided. A wire brush for keeping the material clean before and during welding completes the equipment.

Fig. 4—After the Tubes Are Placed on the Rack No Further Lifting Is Required Until All Operations Are Completed

Electric Flue Welder

Flue welding has been brought to a high state of efficiency by the use of the electric flue welder, as shown in Fig. 4.

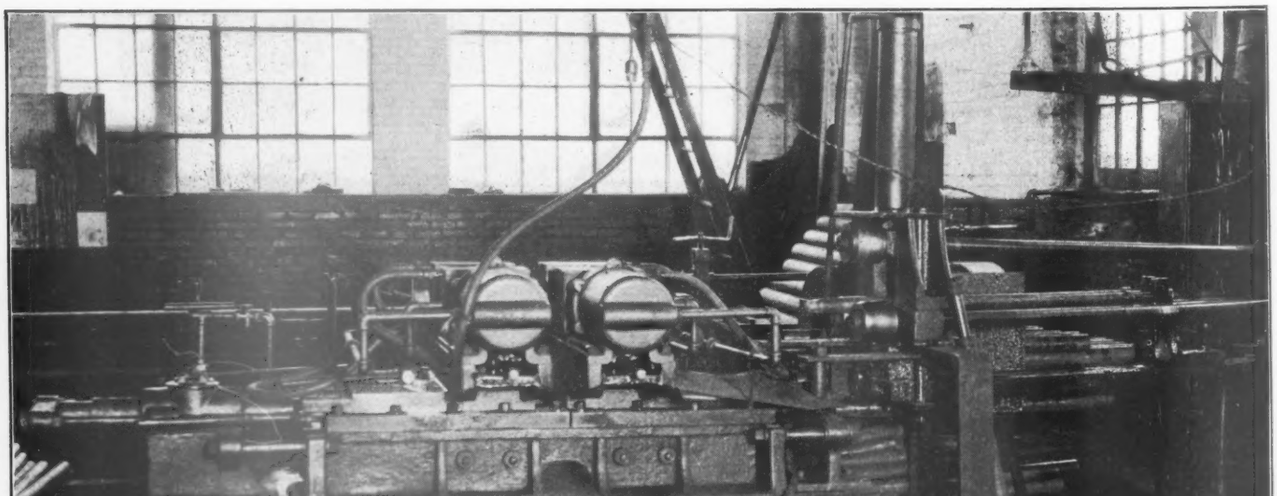


Fig. 5.—This Machine May Be Used for Reclaiming Pipe as Well as for Welding Flues

This machine is made by the Thomson Electric Welding Company and has been recommended by the Master Boilermakers' Association. At the present time it is handling an average of 75 flues per hour. The operation of the machine shown in the illustration is very interesting. After the tubes are cut off they are placed on an elevated rack and all op-

erations are completed without further lifting. The flues are first cut off and then polished with an abrasive belt and welded. The bulge caused by the welding is reduced and the flues are finally heated in a furnace for swedging.

Fig. 5 shows another Thomson flue welder which may also be classed as a reclaiming machine. It is the common practice to weld safe ends on boiler tubes up to 12 in. only, but this machine is equipped with a new rolling device which makes it possible to apply safe ends up to four feet in length. This machine is also adaptable for reclaiming pipe from 2 in. to 5½ in., which effects considerable saving in a railroad shop. The operation of these machines is safer than the old method of oil welding as there is no smoke, glare, or sparks and the weld is always in full view.

Thermit Welding

The fundamental difference between the thermit and the electric or acetylene processes is that the metal added to

Fig. 6.—Thermit Outfit Set Up for Welding a Locomotive Frame

the broken part is produced in a crucible and is poured at one time. The thermit method is used to a great extent in welding frames as well as in switch and frog work. Fig. 6 shows a thermit outfit set up ready to pour molten metal in a locomotive frame and consists of a crucible in which the thermit is mixed and heated. This sort of a job is performed by cutting out a portion of the frame and filling the opening with a wax mold.

Jacks

When welding frames and structural work it is essential that the proper expansion be secured to produce a solid weld. In most work of this nature a ball-bearing jack should be used. Small jacks should be available to take care of the small frames as well as large ones for the larger frames. Large jacks should be mounted on wheels to eliminate the time usually taken in hunting for a truck.

The Sand-Blast

To make a perfect weld it is essential that the surfaces to be welded be perfectly clean metal. The sand-blast is the fastest and most effective apparatus for producing a thoroughly clean job. The blast used on this road is of the portable type and is operated on the air syphon principle. This syphon consists of a pipe which extends to the bottom of the tank and is equipped with a pipe tee, air nozzle and a sand nozzle, which is operated by a valve. All operations of the sand-blast when used in the shop should be screened to protect the machinery and the workmen. The screen shown in one of the illustrations will answer all purposes. It is constructed of canvas fastened to a frame of pipe, which is constructed in sections of 4 ft. by 7 ft. each, and may be made into as many sections as is necessary for different classes of work.

To maintain the maximum production it is necessary that an air hoist be installed to handle all hot and heavy pieces of material that are in the welding shop. Welding is a nervous and tedious job and all unnecessary strains on the operator such as lifting or working a chain hoist, should be avoided.

Changing Trailing Truck Springs

By John Connelly

Locomotive and Car Foreman, Bessemer & Lake Erie, Butler Transfer, Pa.

ON February 19, 1924, locomotive No. 902 was made ready for train No. 10, which leaves Butler at 2:45 p. m. About 50 minutes before time to leave Butler Transfer it was discovered that the locomotive which is a Pacific type, had a broken trailing truck spring. The engine was placed on the pit at 1:25 p. m. and work was started. At 1:50 p. m. the engine was ready for service, just 25 minutes from the time it was placed on the pit.

The total time consumed by four men in performing the actual work of removing and replacing the spring was 25 minutes or a total working time of 100 minutes, which is equal to 1⅔ man-hours. I think we have established a record that will compare very favorably with terminals that have better facilities, such as a drop pit, pit jack and other devices.

The following equipment is used for this job: A removable section of rail on the pit track, 36 inches long, one fifty-ton jack, one smaller jack and an oak plank, 8 to 10 ft. long by 2 in. thick. The work is performed as follows:

1. Place the locomotive so that removable section of rail is between the back driving wheel and the trailing truck wheel.
2. Let out the driver brakes, place a fifty-ton jack in the pit and remove the section of rail.
3. Move the locomotive back until the driving wheel drops into the opening where the section of rail has been removed. This permits the driving box to drop away from the frame.
4. Place blocks in the space between the driving box and the frame.
5. Move the locomotive forward until the back driver is again on the rail.
6. Replace the section of rail.
7. Move the locomotive forward until the trailing truck wheels are over the removable section of rail.
8. Run the fifty-ton jack that is in the pit out about six inches and then place it, reversed, under the trailing truck axle next to the wheel. Fit and jack high enough for the trailing truck wheel to clear the rail.
9. Place the small jack under the back end of the long equalizer, close to the end of the trailing truck spring and raise the equalizer as far as it will go.
10. Remove the section of rail and lower the trailing truck axle until the weight is off the trailing truck spring.
11. Disconnect the spring hangers and take the broken spring out.
12. Place one end of the plank on the trailer truck journal box and roll the new spring into position.
13. Connect the spring hangers, raise the wheel, replace the section of rail and lower the jack under the equalizer and axle.
14. Move the locomotive back until the trailing truck wheel is off the removable section of rail. Remove the section of rail and move the locomotive back until the rear driver drops into the opening. Remove the blocking from the top of the driving box. Move the locomotive forward until the rear driver is again on the rail and replace the section of rail.
15. Adjust the driver brakes and the job is complete.

Boiler Makers' Convention Proved Successful

Autogenous Welding and Removing Firebox Sheets for Renewal Among Subjects Discussed

THE Master Boiler Makers' Association held its fifteenth annual convention at the Hotel Sherman, Chicago, May 20 to 23. The total registration of members, supply men, ladies and guests was approximately 750, of which nearly 300 were members of the association. The Boiler Makers' Supply Men's Association was represented by 57 different companies whose exhibits were shown on the mezzanine floor of the hotel.

E. W. Young, assistant to the general superintendent of motive power of the Chicago, Milwaukee & St. Paul, president of the association, called the meeting to order Tuesday, May 20, at 10 a. m. Following the usual opening exercises, H. T. Bentley, general superintendent of motive power, the Chicago & North Western, was then introduced and, in an address to the men on their duties as the leaders in locomotive boiler maintenance work, expressed his appreciation and admiration of all craftsmen who have gone through the arduous days of the apprentice and journeyman and finally reached their positions as the masters of their trades. These men in whose hands rest the responsibilities of properly conditioning the motive power of the nation, Mr. Bentley said, should strive to be worthy of their trust and in every way better themselves in their work, and the managements of the railroad should see to it that their master boiler makers were present at the conventions.

On the technical phases of the work of the association, Mr. Bentley expressed the hope that the association in its discussions would be able to throw light on the problem of pitting and corrosion of boilers, which so far has found no solution in the laboratory or in the hands of practical investigators. He outlined the need of apprentices in the shop who would later on be fitted to carry forward the work of the masters of the trade who were retiring. Water treatment and its value in cutting, operating and maintenance expense in bad water districts, quality of material and possible improvements, and the work of the chief inspector of the Bureau of Locomotive Inspection in developing and standardizing the use of water columns, were all commented on in his address.

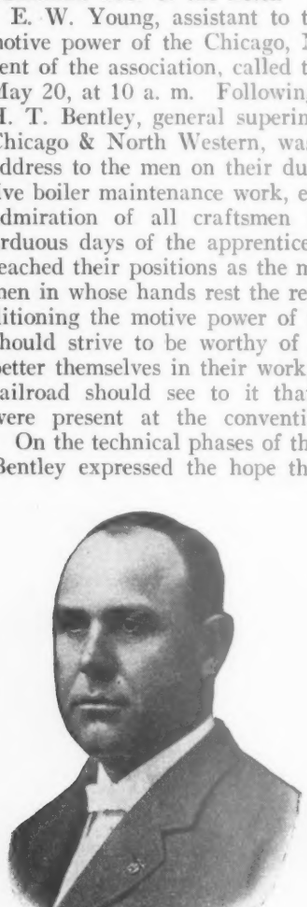
The president's annual address which followed was mainly devoted to an outline of the duties of members of the association in faithfully attending all sessions of the convention and getting the maximum benefit out of the proceedings to improve methods in their own shops when the convention was concluded.

The reports of the secretary and the treasurer indicated that both the membership and financial conditions of the association were showing a healthy growth, with few resignations.

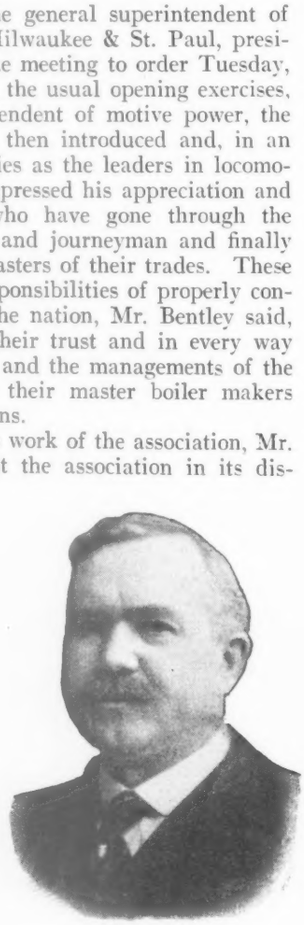
A communication from Hon. Herbert Hoover, secretary of the Department of Commerce, was read by the secretary asking for the co-operation of the association in improving the movement of coal during the summer and early fall months of the year. A memorandum promising the co-operation requested to the best of the ability of the members in their capacities in the maintenance of motive power of the country is to be prepared and forwarded to Mr. Hoover.

An invitation to send a representative to sit in on the Advisory Council of the Federated American Engineering Societies is being acted on by the executive board of the association.

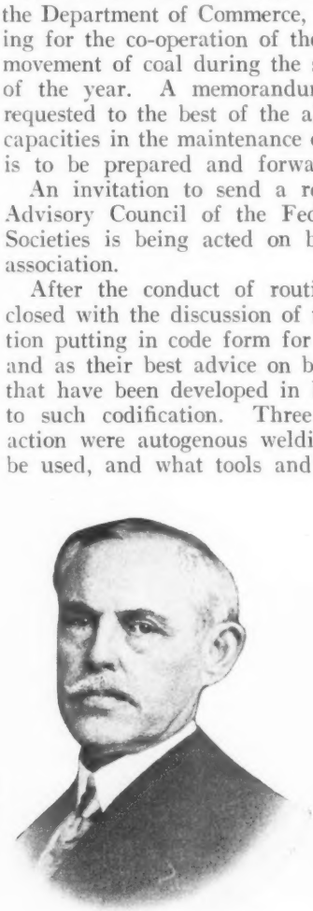
After the conduct of routine business, the first session closed with the discussion of the advisability of the association putting in code form for suggested use of the members and as their best advice on boiler methods, certain methods that have been developed in boiler work that are amenable to such codification. Three subjects suggested for early action were autogenous welding; how and where it should be used, and what tools and methods can best be adopted as standard in locomotive boiler work; flue welding and the proper methods of applying flues, and methods of staying crown sheets.



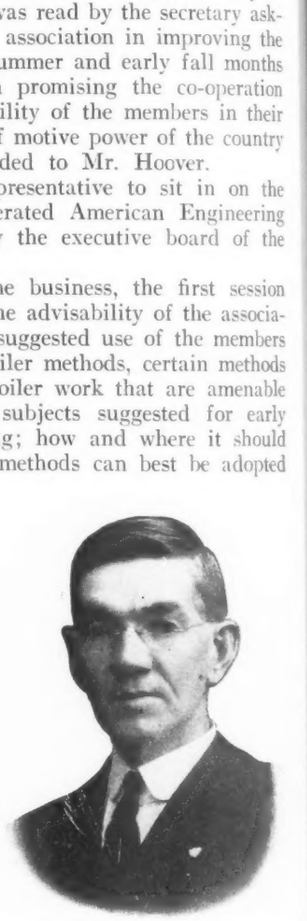
E. W. Young
President



Frank Gray
1st Vice President



Harry D. Vought
Secretary



W. H. Laughridge
Treasurer

The Wednesday session opened with an address by J. E. Bjorkholm, assistant superintendent motive power, Chicago, Milwaukee & St. Paul, in which he emphasized the duty of every railroad officer to improve service with safety. In this the boiler maker has a most important duty, the promotion of safety through proper maintenance. Boilers are sometimes responsible for engine failures, but their number is fast decreasing. Clean boilers are safe boilers and the importance of keeping them free from scale and mud cannot be too strongly stated. No locomotive is usable unless boilers are in proper condition and officials are beginning to recognize the importance of boiler makers in maintaining service.

John Purcell, assistant to the vice-president in charge of operations of the Atchison, Topeka & Santa Fe Railroad opened the session on Thursday with an address in which he stated that he had gained the impression during his career that the construction, inspection and maintenance of the locomotive boiler is more important than the machinery parts. The expansion and contraction forces caused by the difference in temperature cannot be held and provision for their free movement must be made by giving them all the flexibility of staying and bracing it is practicable to allow. He also dwelt on the importance of maintaining as nearly as practicable, equal temperatures in all parts of a boiler at all times. The importance of an efficient and highly trained staff of boiler inspectors cannot be over-stressed. Those in the larger roundhouses have the very best opportunity to cultivate and develop their powers of observation and judgment in their work, each case investigated broadens their experience and strengthens the judgment which fits them for further responsibility. In other words, Mr. Purcell said, by constant practice in locating defects, carefully looking for the cause, and devising ways to correct them, a man soon qualifies himself as an authority on such matters and increases his value to his employer and himself.

The Friday morning session opened with a most interesting and instructive talk by W. J. Tollerton, general superintendent of motive power, Chicago, Rock Island & Pacific.

Officers Elected for the Coming Year

The following officers were elected for the coming year: President, Frank Gray, C. & A.; first vice-president, Thomas F. Powers, C. & N. W.; second vice-president, John F. Raps, I. C.; third vice-president, W. J. Murphy, Penn.; fourth vice-president, S. M. Carrol, C. & O.; secretary, H. D. Vought, New York; treasurer, W. H. Laughridge, Hocking Valley.

Abstracts of some of the reports and papers presented at meetings of the convention follow.

The Application of Thermic Syphons

The committee investigating this subject reported that the application of thermic syphons increases the life of firebox sheets and flues, basing its belief on the following facts:

By the application and use of thermic syphons a very active circulation of the boiler water is set up and maintained. The circulation, sweeping all parts of the boiler, tends to equalize or reduce the range of temperatures of the boiler parts which would be exposed without thermic syphons. This in turn reduces the stresses that are accountable for cracks, leaks and heavy maintenance expenses.

Many reports were received showing a reduction in boiler work in general repairs, when the locomotive was syphon equipped, as compared with non-syphon equipped locomotives of the same class and service. The committee is also of the opinion that the thermic syphons will be a great help to the crown sheet as they cause a fountain action of the water on this sheet and prevent it becoming overheated. The committee expressed the opinion that the thermic syphon also acts as a substantial support for the crown sheet in cases of emergency. Syphon equipped locomotives have successfully passed through low water accidents. The unusual shape of the overheated area clearly proves that the water continued to flow over the crown sheet after the water protection had ceased.

The following extract from circular No. 260 of December 12, 1923, issued by A. G. Pack, chief of the Interstate Commerce Commission, Bureau of Locomotive Inspection, Washington, D. C., was offered to substantiate their findings:

"We are receiving many alteration reports from a number of different carriers showing the application of thermic syphons and, so far as it has been brought to my attention, there has nothing yet been developed which would indicate a reason why their use should not be extended. They add materially to the direct or firebox heating surface and improve water circulation, which is essential to economical and successful boiler operation, and will deliver a certain amount of water to the crown sheet after it has become below this level, which may obviate what otherwise might become a serious explosion with fatal results.

"Syphons also add some beam and brace support to the crown sheet—they being attached to the crown sheet and at the throat sheet—which may prevent the crown sheet from coming down with a crash in case of low water."

This report was submitted by the following committee: A. F. Stiglmeier (N. Y. C.), chairman; Henry J. Rapps (I. C.), John J. Keogh (C. R. I. & P.); H. J. Wandberg (C. M. & St. P.) and A. C. Dittrich (M. St. P. & S. S. M.)

Autogenous Welding and Its Uses

Autogenous welding is used in boiler, blacksmith and machine shops, ship yards, factories; also by sheet metal workers and pipe fitters for new work and repair work in various branches of the metal trades.

During recent years many and improved devices have been placed on the market, which enables the work to be done with greater efficiency. New alloys have been developed for welding rods and electrodes, which enable the operators to perform autogenous welding with greater efficiency. But we must not lose sight of the fact that before a welder may perform autogenous welding in fireboxes, he, like other mechanics, must have a knowledge of the tools he uses and must also learn to properly heat and make perfect fusion of metals continuously by his control and manipulating of the welding blow pipes, filling rods and electrodes used for the purpose: he should be required to make a test weld of at least 75 per cent efficiency from the original stock of steel used in fireboxes. He should be required to make at least one welded specimen monthly. By so doing, the master boilermakers and the railroad companies may know the efficiency of the welder performing the work, and the man having the highest efficiency is undoubtedly the man whose work will show the best results.

The success of a welding job depends a great deal on how it is prepared, and for this reason the autogenous welder and boilermaker should see that the plates are properly bevelled and edges thoroughly cleaned from dirt, scale and grease. Plates should be secured in position with suitable strut belts, clamps or wedges, with the proper opening to enable the autogenous welder to perform the welding all the way through the plate and make the weld solid.

Autogenous welding is now used in many ways to advantage for the following reasons:

Its application is better known and becoming more efficient.

The cost of application in many instances is less.

In many cases the use of the process reduces the cost of maintenance to the locomotive firebox and other parts.

There is a saving in the operation of the locomotive.

When the flues are welded in back flue sheets, there are less leaks, therefore, a better steaming boiler. When there is a good steaming boiler, there is a fuel saving locomotive. When there are less leaks, there are not as many locomotive failures, therefore, less delays and a reduction in operating costs.

For further advancement of the process, it is essential that all operations be given careful consideration and study, which is so necessary for the further development and advancement of the autogenous welding processes.

This report was prepared by a committee composed of H. H. Service, chairman; R. W. Clark, Isaac J. Pool, G. M. Wilson and J. L. Wells.

[Abstracts of other papers will appear in later issues.—EDITOR.]

Reclamation of Angle Cocks

By A. Skinner
Air Brake Foreman, A. T. & S. F., Corwith, Ill.

A LARGE number of angle and cut out cocks are constantly being received at the reclamation yard with worn threads on the brake pipe end. It became necessary to devise other means of reclamation than that of the drill press which was too slow and required too much handling in order to take care of all that were coming in. As a result a 14-in. Warner & Swasey turret lathe was added to the shop equipment and the writer decided to try the work of

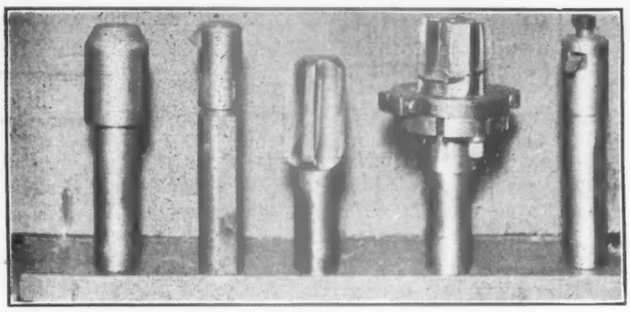


Fig. 1.—Set of Tools Used on the Turret Head

boring and tapping the angle cocks on this machine. A bracket for the lathe screw and the necessary tools to fit in the turret head were made and after lining up the lathe and trying out a few cocks the results were quite gratifying. It was found that five complete operations could be performed in the same time that was formerly required for one operation with a drill press.

The actual time to complete the five operations was four

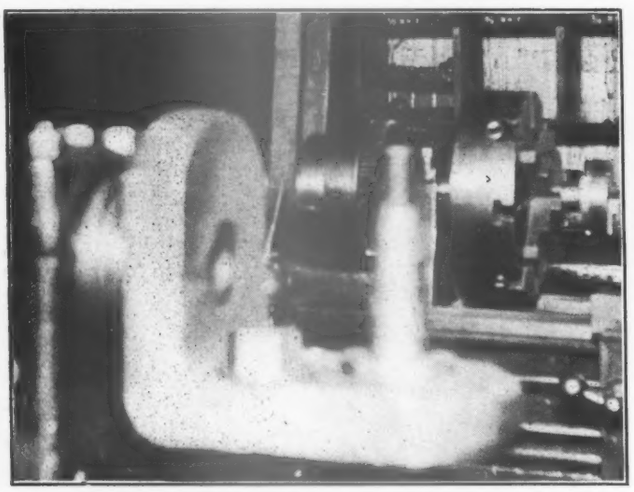


Fig. 2.—Bracket for Holding the Angle Cock on the Lathe Screw

minutes, but this tended to crowd the lathe so we are satisfied to limit production to 100 cocks in eight hours.

The tools used on the turret head are shown in Fig. 1. Reading from left to right, the set consists of a centering tool, a boring tool, a reamer, a Burrit pipe tap with removable chasers and a counterboring tool. Fig. 2 shows the bracket for holding the angle cock on the lathe screw. This device is simple in construction and is provided with a bolt tapered to fit the angle cock body as shown in Fig. 3.

In addition to boring and tapping angle and cut out cocks, the standard self locking handle, P.C. 20128, is also reclaimed. New keys are fitted where necessary and by so doing many cocks are put back into service that would otherwise be scrapped. No cocks are scrapped unless they are broken and beyond repair. The test is as rigid as it can

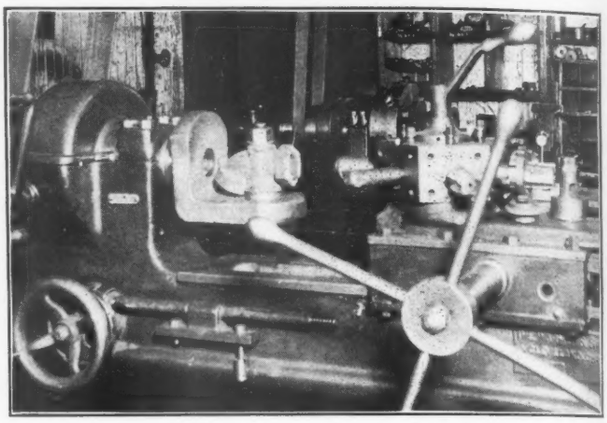


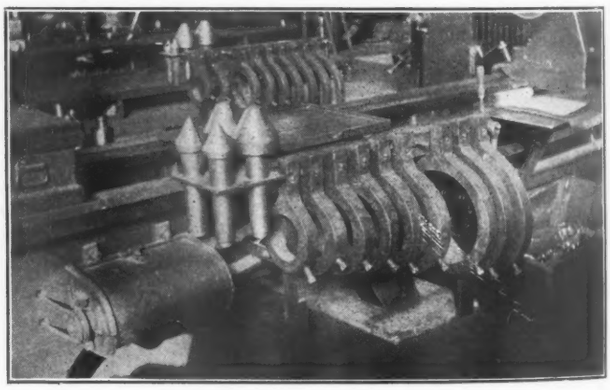
Fig. 3.—Angle Cock in Position to Receive the Centering Tool

be made. Every cock receives individual attention and must come up to standard before being returned to service.

A Rack for Holding Lathe Dogs

By J. Robert Phelps
Apprentice Instructor, Atchison, Topeka & Santa Fe, San Bernardino, Cal.

THE usual method of taking care of lathe dogs in a machine shop is to pile them in an out-of-the-way corner or throw them on the floor where they are covered with an accumulation of oil and dirt. They also interfere with the floor sweeper as he has to move them from one place to the other in the performance of his duties. The illustration



A Rack for Holding Lathe Dogs and Lathe Centers

shows a device that is being used in the machine shops of the Atchison, Topeka & Santa Fe at San Bernardino, Cal., which keeps the lathe dogs and centers up off the floor and within convenient reach of the operator.

Lathe centers are considered one of the most important things about a lathe. By keeping the extra centers out in plain view they will not get chipped or damaged so readily as they do when they are either on the floor or put away in a drawer with other tools. The foreman can see them at all times, which enables him to keep a check on his men so that they will have the various sizes of centers in condition to be ready for use to take care of any emergency job that may come in. This arrangement is especially recommended for lathes handling axles and crank pins which require a wide range of sizes of dogs and centers.

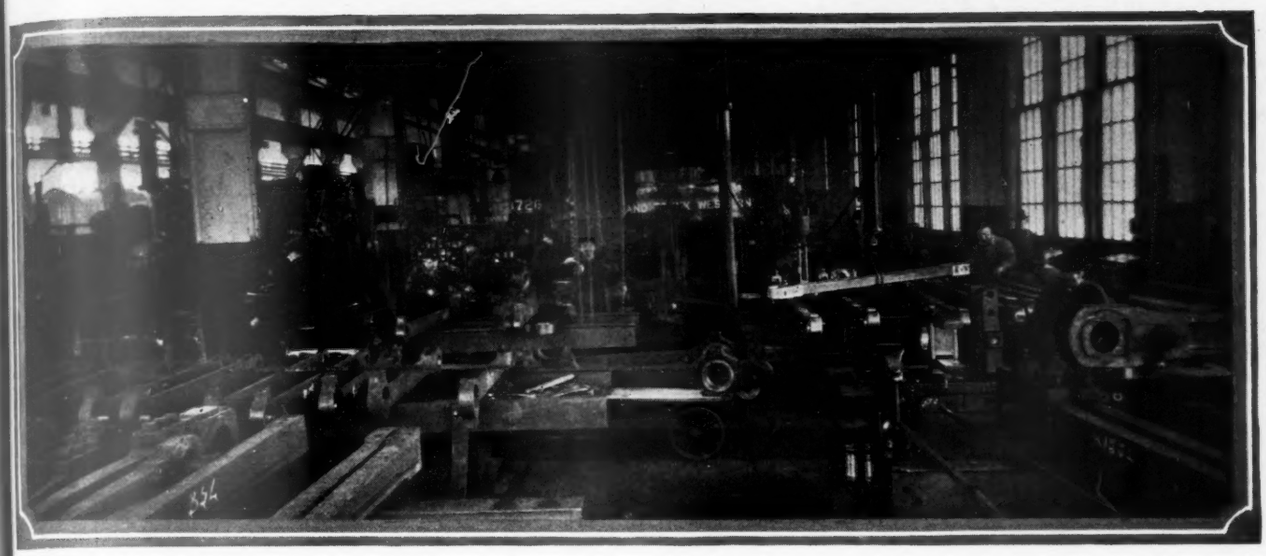


Fig. 1—General View of the Rod Department

Handling Rod Work at Battle Creek Shops

Prize Winning Article Submitted in Rod Job Competition—Methods Are Constantly Being Improved

By M. H. Westbrook
Shop Superintendent, Grand Trunk, Battle Creek, Mich.

THE rod repair department at the Grand Trunk shops, Battle Creek, Mich., is equipped and laid out to take care of a 22-pit repair shop, handling all the classified repairs to 334 locomotives, including many of the U. S. R. A. Mikado type, and meeting the requirements of eight roundhouses from which rods are sent to be overhauled or renewed. This department is located under a balcony, as shown in Figs. 1 and 2 which also indicate passages for the gasoline tractor while delivering rods to and from the department. The balcony provides a convenient support for the overhead runway and crane which serves all the benches and heavy machines.

Each Man Handles Special Work

As far as possible, each man is assigned to a certain specified part of the work on the bench as well as on the machines. Thus one man devotes his time entirely to main rod work and others to the side rods. These rods are all carefully trammed as soon as stripped and any distortion or lengthening that may have taken place is corrected, so that the bushings are always bored out concentric and each rod is sent out conforming exactly to standard fixed trams, which are compared to a master gage block each week.

Main rod bolts are kept in stock in the bolt department, rough turned and threaded, the final fit being made as required on a lathe in the rod department situated close to the main rod benches. Knuckle pins at present are being made on an engine lathe, but it is proposed to manufacture these on a turret lathe which is now on order and will be located in the bolt and pin manufacturing department.

All engines are stripped on a special pit, the rod foreman always being present when rods are being removed to check up on reports previously received from the roundhouse inspectors. The rods are then loaded on a trailer and hauled by tractor to the cleaning vat, as shown in Fig. 3 and immersed, with other motion work, in a solution of metal cleaner compound, six ounces to the gallon, and boiled for about two hours. After removal they are rinsed off in the draining bowl located behind the vat and connected to the sewer.

From this vat they are delivered on trailers to the rod department and are then whitewashed with the by-product of the acetylene generating plant. After drying, they are hammered with a five pound copper hammer and carefully inspected for cracks or other defects.

The Condition of Crank Pins Important

As so much of the life of the rods, brasses, etc., depends on the condition of the crank pins and journals, I must digress here for a moment to explain that before any extensive repairs to the rods are commenced, the crank pins are carefully inspected to determine whether they are circular, parallel and in quarter, it being frequently found that a crank pin may be circular and parallel and yet worn very much out of its original quartering. In this case, they are trued up by the two portable crank pin turning machines shown in Fig. 4, one of which is designed for turning pins having threaded ends and the other for pins used in connection with Walschaert gear. Both of these machines are well advertised devices and a very much worn main pin can be turned with either machine in from two to two and one-half hours, inclusive of the time of setting up and removing them.

When crank pins are worn down to the limit of permissible wear, they are, of course, renewed. I wish to emphasize here the necessity of great attention being paid to the condition of crank pins. In some modern shops this is neglected and I have seen men engaged in trying to file the pins true and

round. This is practically an impossibility and what is done with the file usually takes more time than would be required to true the pins accurately with the portable machines.

course of manufacture in many of the railroad shops visited is most noticeable and possibly, if a special investigation were made as to the cause for this, the number could be somewhat

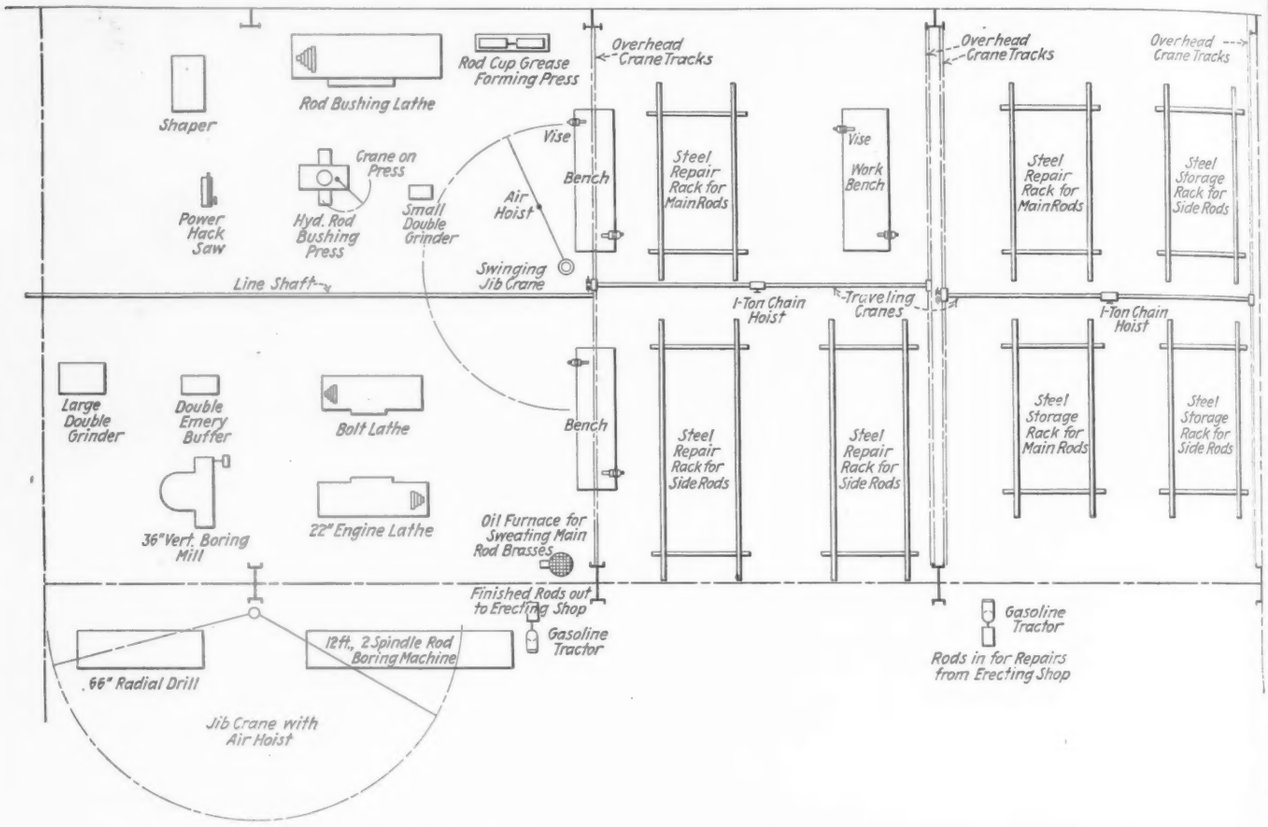


Fig. 2—Plan of Rod Department, Showing Machine Layout, Cranes, Work Benches, Repair Racks and Storage Racks

All new rods are manufactured on a store order in the forge shop from steel billets of the following specifications:

	Per cent
Carbon	0.38 to 0.52
Manganese	0.40 to 0.60
Phosphorus, maximum	0.045
Sulphur, maximum	0.05

They are thoroughly annealed, taking from 48 to 60 hours in the process. Systematic heat treatment of all rods as they

Fig. 3—Tractor and Trailer Used for Handling Rods to and from the Cleaning Vat

are removed when in for repairs has not as yet been adopted, although the matter is being investigated.

The large number of new side rods usually found in the reduced. The comparatively small number of new rods required of the rod department at Battle Creek shops is attributed solely to the special care being paid to the condition

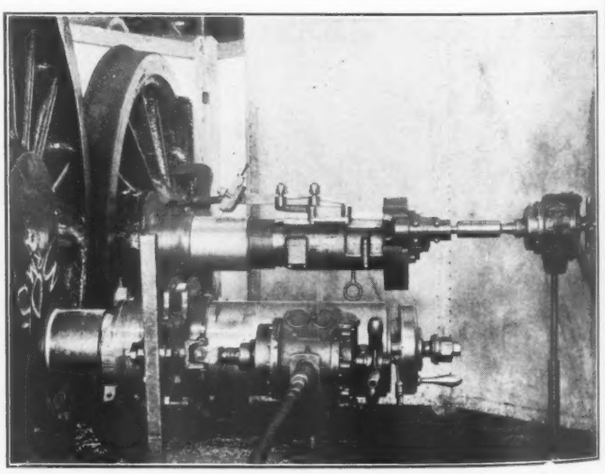


Fig. 4—Portable Machines for Turning Mounted Crank Pins

of crank pins, journals, shoes, wedges, frame jaws and driving boxes.

After the crank pins have been cleaned off, inspected and the necessary reconditioning or renewals completed, the mechanic whose duty it is to perform this work, records the sizes on the 9 in. by 12 in. form shown in Fig. 5—credit for which is given the Beech Grove shops of the Big Four. This

form is sent to the foreman of the rod department and contains all the instructions the machine men require in connection with the bushings and brasses, making it unnecessary for them to go to the wheels, wherever they may be located, to get their sizes. The machines are thereby kept in more continuous operation than if the men had to leave them to obtain these sizes.

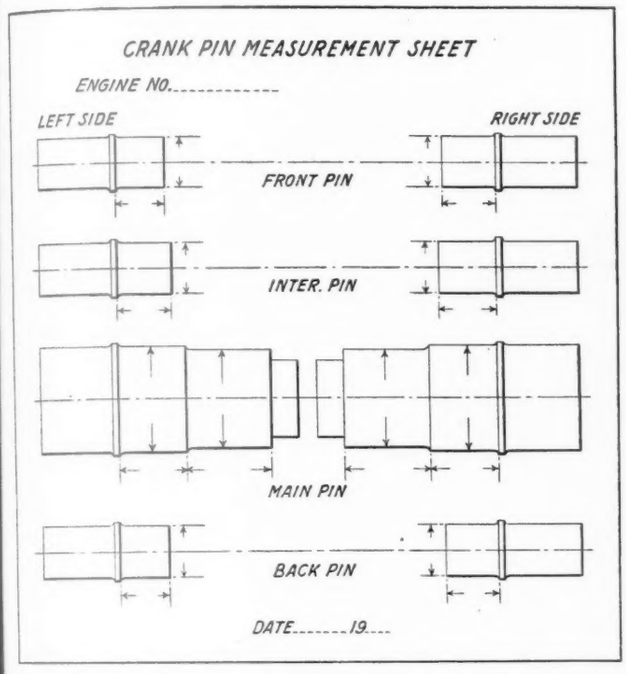


Fig. 5—Form for Recording the Sizes of Crank Pins

All bushings are removed and applied by a motor-driven hydraulic press. All rods are then distributed to the various benches shown in Fig. 1, which are made from 4-in. by ½-in. iron bolted to old sections of 16-in. I-beams split lengthwise in two pieces. The legs are made straight on one side for greater convenience of men working at the benches, and are bolted to the floor.

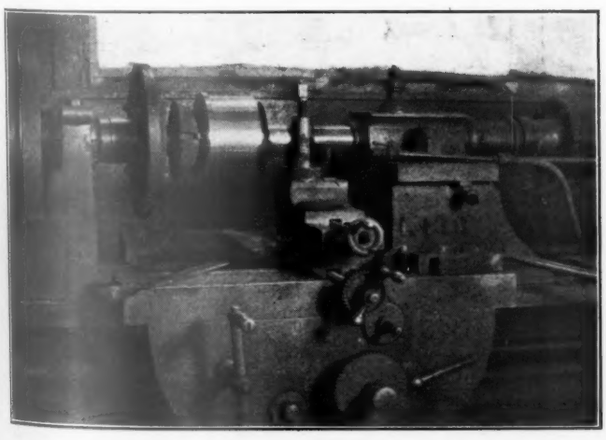


Fig. 6—Air-Operated Arbor for Holding Rod Bushings in Engine Lathe

Most of the bushings are turned on the specially designed arbor* shown in Fig. 6, fitted to an old engine lathe and operated by an air cylinder and piston which takes the place of the tail stock screw and hand wheel. This arbor is bolted to the face plate. It is provided with three blades fitted to angular grooves in the stationary member. Each blade has three steps which are designed to take in every size of bushing used. As air is applied, the blades are forced outwards along the angular slots and hold the bushing while being turned and faced to length by specially shaped tools. It has been found that better time can be made using this device than turning them in the boring mill. A special tool block arranged to hold three tools, one to be used for turning and the others for facing to length, will soon replace the single tool holder shown in illustration, merely being an improvement not yet completed.

*Credit for this arbor, with the exception of the air cylinder which was added here, is due the Chicago & North Western shops at Chicago.

Fig. 7—A 36-In. Boring Mill Used on Rod Work

The 36-in. boring mill shown in Fig. 7 is used for turning bushings when the lathe has more than can be handled in the required time and occasionally for boring main rod brasses as shown for outstations. All boring of main and side rod brasses and bushings is performed on the two-spindle rod boring machine shown in Fig. 8. We graduated the cross rail of this machine to correspond to the various lengths of our rods, attaching an indicator to each head, thereby providing a

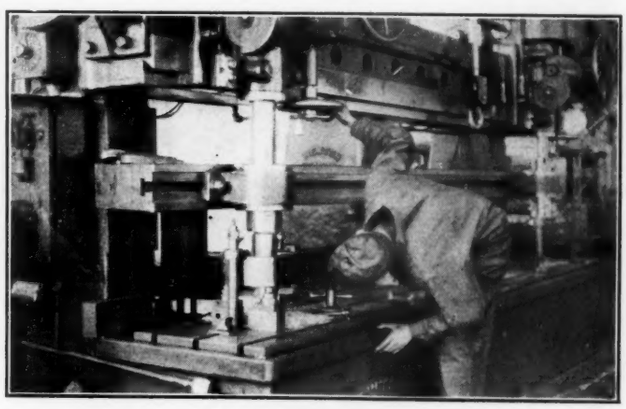


Fig. 8—Adjusting the Cutter on a Modern Two-Spindle Rod Borer

double check on the lengths of rods and ensuring the greatest accuracy in maintaining them to the correct standard lengths.

Two-Spindle Rod Borer Saves Time

Prior to the purchase of a modern two-spindle rod borer, this work was handled on an older type machine and while

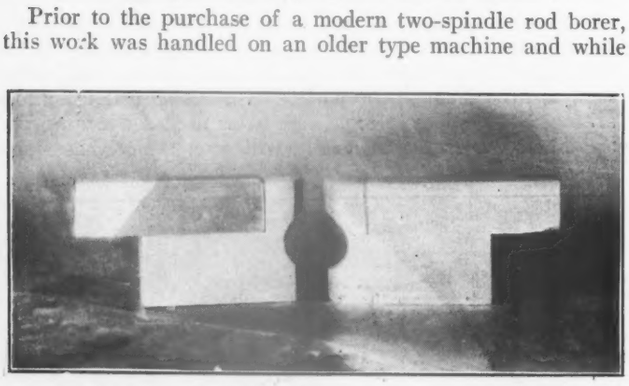


Fig. 9—Short One-Inch Square Tools Are Inserted in Worn Davis Cutters

fairly satisfactory results were obtained, the difficulty encountered in correctly aligning the rods for boring on the machine caused considerable delay or inaccuracy or both. The installation of the machine shown in Fig. 8 is one illus-

Fig. 10—Bushing Keyways Are Cut on a Shaper

tration of many things which have been done to "organize and improve the rod department."

Both ends of the main rods are bored with special Davis boring bars and faced on both sides with one setting, a long one-inch square facing tool, ground to under-cut from the bottom, being loosely inserted from underneath and fed upward the required amount. This makes a first class job, and saves an extra setting. The whole operation is frequently completed, floor to floor, in one hour. Fig. 9 shows how a considerable saving of cutters was effected by utilizing short one-inch square tools inserted loosely in worn down Davis cutters. The method of cutting keyways in the bushings is shown in Fig. 10.

We have experimented with various tools for the removal of the solid cores from new rods but must admit that so far we do a quicker job by first drilling a pilot hole in the center of the rod and using a series of double end cutters, ground especially for cutting steel. The piece is bored out from the solid rather than by using what is known as cat-head cutters

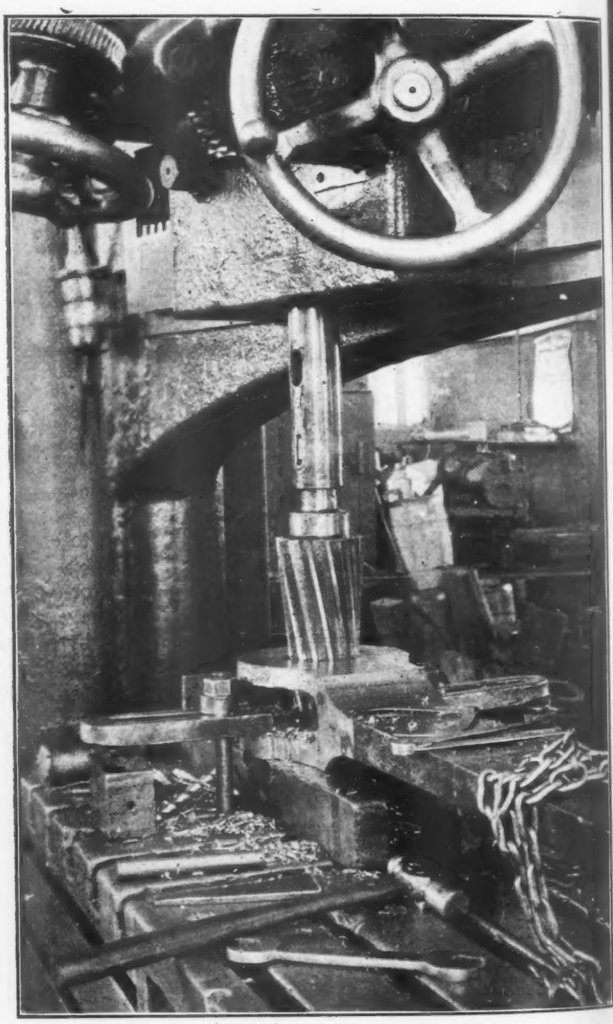


Fig. 11—Reaming Side Rod Knuckle Pin Hole

or hollow mills which in some shops are said to successfully remove the solid piece.

Reaming the bolt holes for big end straps is performed in a most satisfactory manner on a radial drill. By the use of the left-hand, hot-twisted, four-fluted reamers, wonderful results are obtained. These reamers are operated at a speed of 55 ft. per minute, or approximately 140 r.p.m., using a hand feed much coarser than the automatic feed of the machine is capable of taking.

With the 8 or 10-fluted reamers generally used for this operation, the operator is frequently obliged to withdraw them from the hole to clear the chips, and often through fear of breaking the reamer, uses a finer feed than necessary. The reamer described has plenty of chip room and consequently

will work successfully at high speed and coarse feeds. It is unnecessary to remove the reamer at all, when once started, to clear the cuttings from the flutes. It has also been found that a good soluble oil coolant, costing from three to five cents per gallon, makes as good a hole for this operation as the best high priced cutting oil.

Machining the main strap fit on the brasses is performed on a slotter with a special indexing angle plate and arbor combined. The average time on this is approximately one

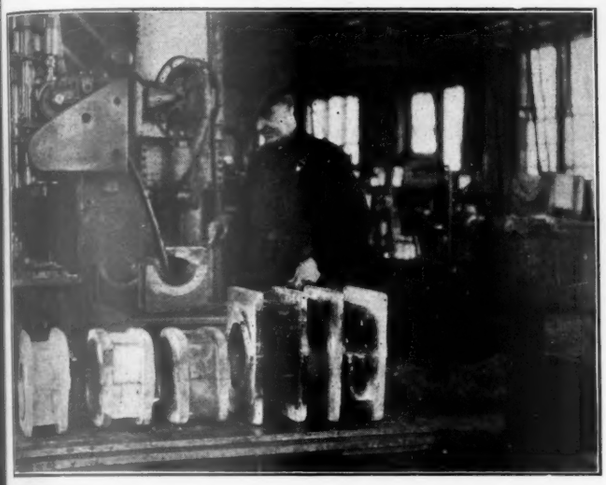


Fig. 12—Operation of Sweating Main Rod Brasses Together

and one-half hours each. I believe this is being done in some shops in less time on a milling machine, but so far we have not been able to get milling cutters to stand up on the bronze used in these castings, although experiments are being continued.

Attention Given to Knuckle Pin Holes

The knuckle pin holes are reamed out as shown in Fig. 11 and on the same machine used in reaming the main rod bolt holes, the left hand spiral reamer, with liberal chip room,

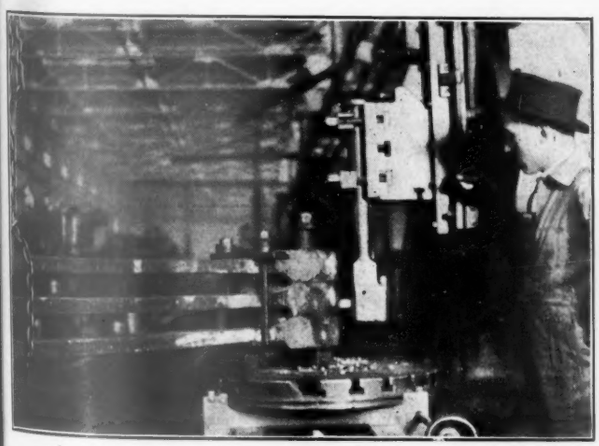


Fig. 13—Slotting Three New Rod Ends at the Same Time

being found the most suitable tool. These reamers are all bored out to fit a standard driving spindle having a threaded end and are held in place by a nut.

Brasses are sweated together at an oil furnace as shown in Fig 12. Experiments are now being conducted with a lead bath for heating these brasses, as we do not believe the method now used to be the most efficient.

Ends of new rods are machined as shown in Fig. 13, using the same machine as is used for slotting the brasses. While it is said that a heavy vertical milling machine performs this operation very quickly, a machine of this type not being available, the method shown makes a very quick and creditable job.

Various methods are used in cutting out the fork ends.

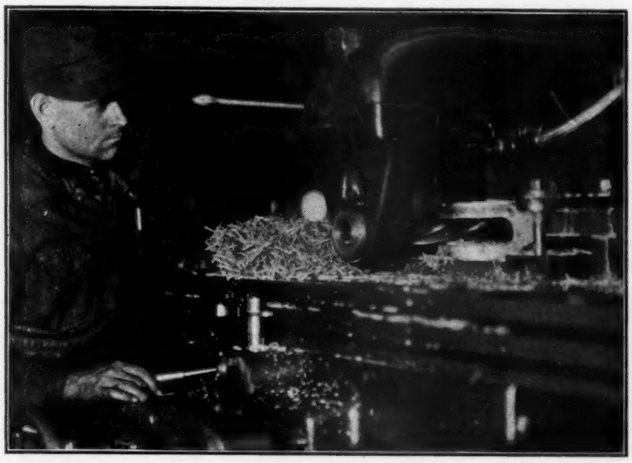


Fig. 14—Side Rod Fork Ends Are Cut Out on a Vertical Knee-Type Milling Machine

Among them the writer has seen a two-inch hole drilled through the end of the desired slot, then machined out to size on the slotter; he has seen the rod drilled for clearance and twin saws used to cut out the piece, after which it is finished

Fig. 15—This Cutter Which Cut Very Freely, Would Not Stand the Feed

on a slotter. Either of these methods takes from 4 to 6½ hours per rod. By the method shown in Fig. 14, this whole operation can be completed from floor to floor in a half hour.

It may be of interest to describe here some results obtained

while experimenting with special milling cutters for this operation. Fig. 15 shows a form of cutter which gave excellent results. It was very free cutting, but broke too easily when forced to a feed of ¾ in. per minute. Possibly this was the fault of our tempering process or of insufficient chip room.

We intend to continue experimenting with various forms of

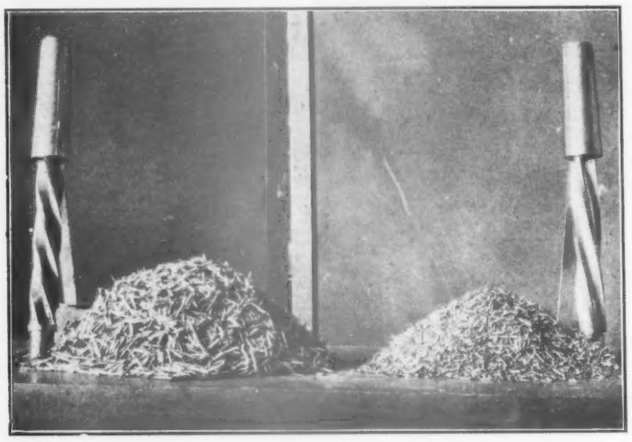


Fig. 16—Pictorial Proof of the Importance of Correct Spiral and Cutter Tooth Form

cutters for this operation, but have not sufficient call for these rods to permit extensive tests. It is suggested that some of the larger shops pursue this interesting feature and publish the results obtained in the *Railway Mechanical Engineer.*

Fig. 17—New Rods Are Machined on a Slab Miller

Fig. 14 shows the best form of cutter so far developed. This was made by converting a taper locomotive reamer used in reaming main rods. This reamer was ground parallel, cut off to the required length, the outer end built up with bronze by the acetylene process and turned to fit the overhanging arm of the milling machine. This tool has cut several fork ends out of the solid in an actual cutting time of less than 15 minutes and is in about as good condition as when first started. It is 2 1/32 in. diameter and while it retains that size but one cut is necessary. After it is ground it will, of course, be necessary to take a second cut, which can be done at a greatly increased feed. These reamers are made from a special rolled section of high speed steel and twisted while hot, which very probably accounts for their strength and durability. A heavy, continuous flood of good coolant is necessary to get good results or make fast time on this operation.

Fig. 16 shows an interesting comparison of the cuttings obtained from two cutters, each doing the same amount of work on two rods made from the same billet at the same time and annealed together. The cutter to the left is that shown in Fig. 14 milling out the fork end of the rod, the one on the right was made slightly heavier and with a somewhat different spiral angle. The cuttings in each pile weigh the same but those made with the cutter on the left are much more loosely curled and at a feed of ¾ in. per minute it went along without difficulty, making a fine curly chip which it was a pleasure to watch rolling out. The other was in frequent difficulty and the feed had to be released occasionally for a few moments for fear of breaking the cutter.

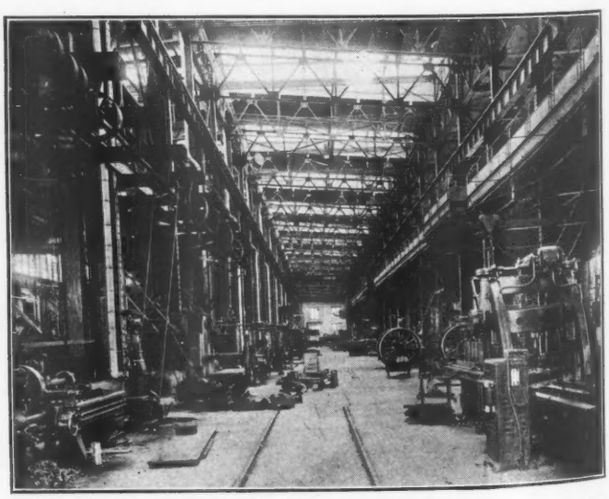
New Rods Milled in Pairs

Because machines used in the manufacture of new rods are employed on this special class of work only a small part of the time, they were not located in the rod department but in a centralized general manufacturing department where the full time of such machine tools may profitably be utilized in other lines of work.

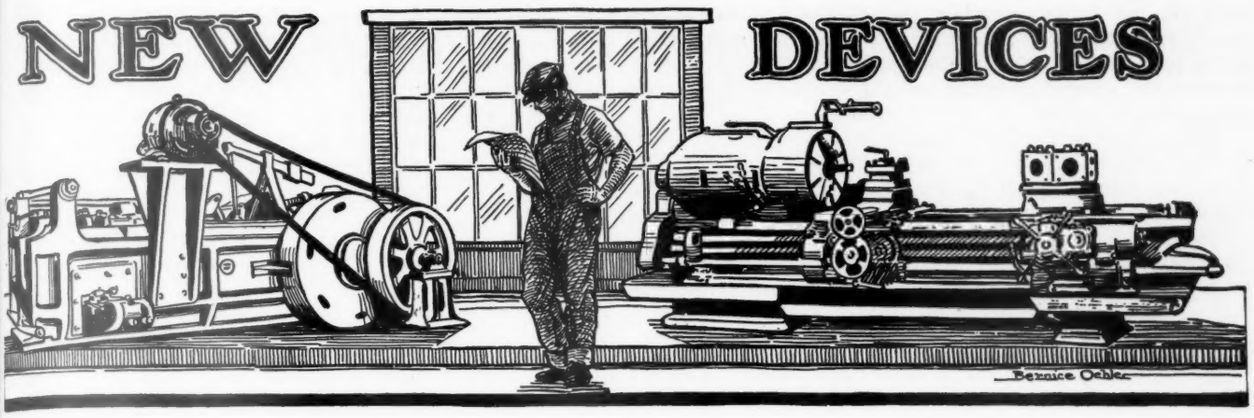
Fig. 17 shows a pair of main rods in the course of manufacture. They are milled in pairs wherever possible. Larger shops would no doubt prefer a larger machine but the writer has found it quite possible to equip a shop with larger tools than can be used to the best all round advantage, which of course cannot be properly discussed in this article.

The rod work is of course scheduled along with other work required on the locomotives under repair. A full account of the scheduling system appeared in the August, 1923, issue.

This article may not describe the best rod department in the country, but at least it is one that is doing good work and what good features it has are the development of suggestions made by various men and foremen, all of whom are interested in having their departments efficient.



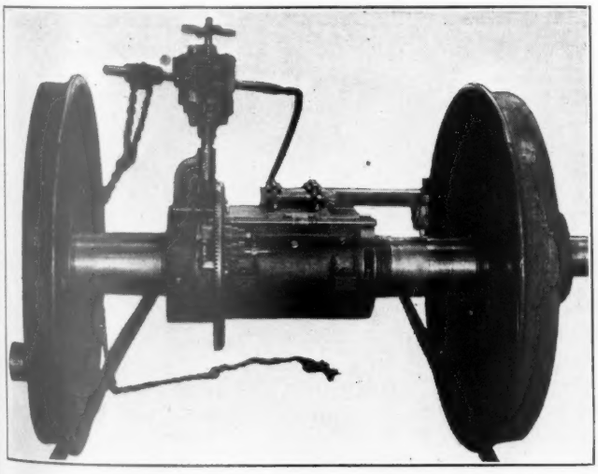
Interior View of the Machine Shop at the Billerica, Mass., Terminal of the Boston and Maine



Marsh Portable Journal-Turning Machine

MANNING, MAXWELL & MOORE, INC., New York, is offering the Marsh portable journal turning machine, which is designed to true up journals on the driving wheel axles of a locomotive without having entirely to remove the drivers from under the locomotive. It is intended primarily for the use in roundhouse for quick repairs. It can also be used in erecting shops for truing up journals on driving wheel axles in cases where new tires are applied to the wheels in the erecting shop and where it is desired to relieve the driving wheel lathe of the journal work.

The machine consists of two principal parts; namely, the stationary or inner sleeve which is provided with a suitable



Journal Turning Machine Which Can Be Applied Without Removing the Wheels from the Locomotive

clamping mechanism for attaching it firmly on the central part of the axle, and the outer or revolving sleeve which rotates on a bearing on the inner sleeve and supports the carriage for the cutting tool and the feed mechanism. The inner sleeve has four tee slots cut longitudinally in its inner circumference and spaced equally around the circumference. Four wedges are fitted in these slots, and by moving them in the slots the sleeve is clamped or unclamped from the axle. The heads of the wedges are slotted to fit in a circular groove in a single large nut in one end of the inner sleeve so that revolving the nut moves all four wedges backward and forward in their slots in the inner sleeve at the same time. This arrangement provides a universal chucking action and insures the sleeve always being exactly centered on the axle. To provide for clamping the sleeve to axles smaller than the usual capacity of the machine, four steel strips of the same thickness are attached to the wedges by two screws each.

The outer or revolving sleeve is driven by a large bevel gear through a pinion by an air motor fitted on a taper shank, or by an electric motor through belt and pulley. The tool carriage operates on a dovetail type bearing running longitudinally on the sleeve; it is very similar to a lathe carriage.

The tool bar is a steel forging 2 in. square and is held by two screw clamps on top of the carriage. The bar is made of sufficient length to enable the machine to turn journals up to 14 in. in length. The tool holder on the end of the bar is of the swivelling type to enable the tool to get into the close corners next to the hub liner. Provision is also made for feeding the tool down into the work by means of a screw above the tool, which is provided with a lock nut.

The tool carriage is driven by a lead screw operating in a bronze nut on one side of the carriage. The lead screw is driven through a series of spur gears which are attached to the side of the main bevel drive gear. On the end of the lead screw next to this large bevel gear is a small spur gear which meshes with the larger of three spur gears which are loose on their shaft. A sliding key is provided in this shaft to transmit the drive through whichever of the gears it is desired to use. Thus are provided three changes of feed. This shaft extends through a bearing in the web of the large bevel drive gear and a small bevel gear is attached to the projecting end. Meshing with this small bevel gear are two other small bevels diametrically opposite each other and loose on a shaft which runs parallel to the web of the large drive gear. A sliding key is provided in this shaft, which enables the feed to be reversed, and by setting the key in neutral position, hand movement of the tool carriage can be accomplished by attaching a wrench to a square head on the back of one of the shafts. Bearings for this shaft are provided on a one-piece bracket attached to the web of the main bevel drive gear. On the end of the shaft opposite the square head is attached a small worm wheel and this wheel meshes in a large steel worm 1¾ in. wide, which is inserted in a circular groove cut in the inner or stationary sleeve of the machine. In operation the feed is provided by moving the small worm wheel over the large worm.

To provide for placing the machine on the axle, both sleeves must be made in halves. To insure getting the halves of each sleeve together in proper alinement a longitudinal tongue and groove arrangement is provided on both the edges which come in contact, and in addition to this the bolts which

hold the two halves together are tapered and fitted very closely so that they act as dowels. The inserted worm wheel of the feed mechanism on the outer sleeve and the nut which operates the clamping wedges on the inner sleeve are also both made in halves.

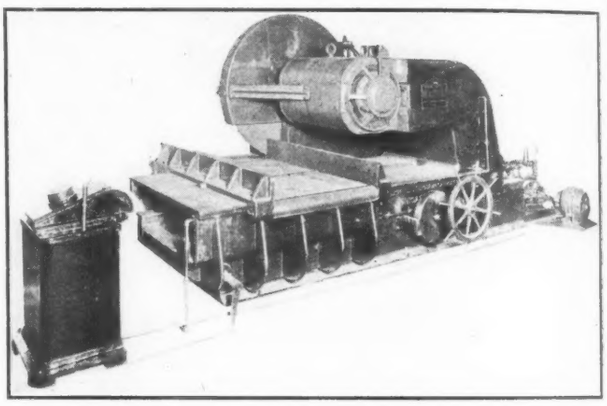
When using the machine in the roundhouse it is only necessary to drop the wheels on which the journals are to be turned far enough below the frame of the locomotive to give the machine room to operate. The wheels can be blocked up and the jack used to hold the lower half of the inner sleeve which must be applied first. With the inner sleeve in place and bolts tight, the clamping wedges can be tightened with a spanner wrench. The outer sleeve can then be applied in the same way and the tool set. It is then only necessary to put on the air motor and begin work. The machine is light enough to enable two men to apply it easily and is sufficiently rigid to enable cuts of ⅛ in. with 1/32 in. feed to be taken without any appreciable chatter.

A Friction Saw Developed for Heavy Duty

JOSEPH T. Ryerson & Son, Inc., Chicago, Ill., has recently added to its line of friction saws a large size which is known as the No. 5. It was developed for heavy duty, and is designed to handle the largest sections rolled. The added capacity of the machine is indicated by the fact that it is driven by a 125-hp. motor, while the largest saw heretofore built by this company is equipped with a 60-hp. motor.

The new saw takes a 61-in. by ⅜-in. blade and the vertical clearance under the hood and flanges is 14¾ in. It can handle the maximum size of I-beams, channels, angles, tees and girder rails, 3½-in. square bars and 4-in. round bars. As shown in the illustration, three rollers have been added to the cutting table to facilitate handling the heavier sections.

The saw is controlled by means of two levers mounted on a control box, which may be located where it is most convenient for the operator. One of these levers controls the water supply and the other moves the saw in or out of the cutting table. The feed mechanism consists of both a hand and hydro-electric automatic feed. The control box is equipped with a voltmeter and an ammeter in order to keep the operator aware at all times of the load on the motor.

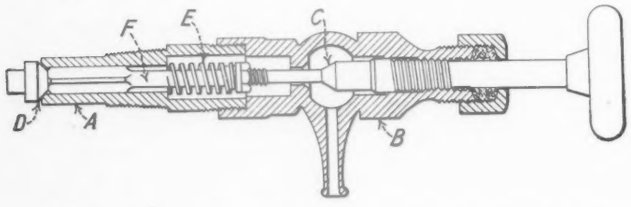


Friction Saw Designed to Cut the Largest Sizes of Channels and Bars

A Gage Cock Permanently Attached to Boiler

THE Buffalo, Rochester & Pittsburgh is using on some of their locomotives a new type of gage cock which was designed and patented by H. C. Vormeng, locomotive inspector on the B. R. & P. at Rochester, N. Y. The principal feature of this gage cock is the ability to grind in the main valve seat without draining the boiler to which the valve is attached.

The drawing illustrates the principle of operation of the gage cock. The inner section of the valve casing *A* is screwed into the boilers and remains permanently in this position. The outer section *B* of the gage cock is screwed in to the protruding end of the inner section *A*. Passing through the two sections of the gage cock is a valve stem containing valve *D* at the extreme end of stem and valve *C* in the valve chamber which communicates with an outlet spout. A coil spring *E* surrounds the outer end of the inner valve stem *F*. Tension applied to the spring by means of the nut and washer as shown. At the extreme inner end of the valve stem are guiding members formed which cause the valve stem to be supported in proper alinement to insure the seating of valves *C* and *D* upon their seats. A study of the illustration will show that by unscrewing the outer section *B* of gage cock from the inner section *A* and likewise disconnecting the inner valve stem *F* the tension of the spring *E* seats the inner valve *D* thereby preventing leakage while the outer valve *C* is removed to be ground.



Valve C Can Be Ground Without Removing the Valve from the Boiler

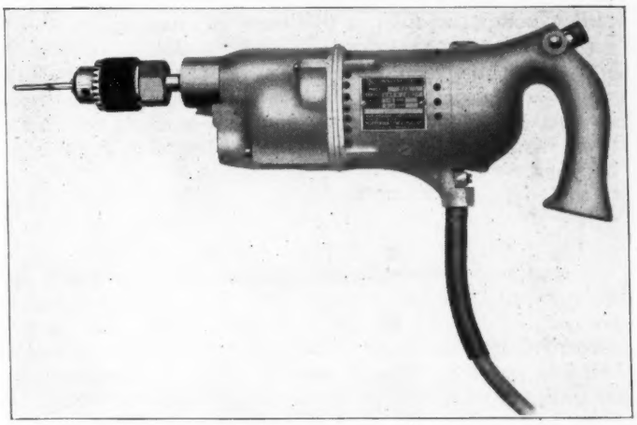
THE TOTAL LENGTH of the world railways, according to the latest figures, now approximates 750,000 miles against about 700,000 miles in 1913, 500,000 in 1900, 400,000 in 1890, 250,000 in 1880 and 25,000 in 1850, these figures being, of course, in very round terms.

Reversible Electric Tapping Machine

A PORTABLE tool for tapping drilled holes, similar in design and appearance to a portable electric drill, has been designed by the Independent Pneumatic Tool Company, Chicago, Ill. It is known as the Thor Reversible Electric Tapping Machine and the size UKR, now being announced, is suitable for tapping holes up to 3/16 in. in diameter and for retapping any size of holes up to 5/16 in. in diameter.

The machine has the same motor as the standard Thor Portable Electric Drill but the speed of the spindle has been reduced to 550 r.p.m. through worm gears which are enclosed in the gear case. The reversing device is mechanical. A slight pressure toward the work will engage the clutch and cause the spindle to rotate toward the right. When the tap has been run in, a pull on the machine immediately reverses the spindle for backing out the tap. It is not necessary to shut off the current between each hole tapped. When no pressure is exerted in either direction, the spindle runs free. The gears may also be locked so that the machine is operative in reverse only.

A universal motor is used so that the machine can be operated on either alternating or direct current circuits of 110 or 220 volts. The weight of the machine is 6¾ lb.

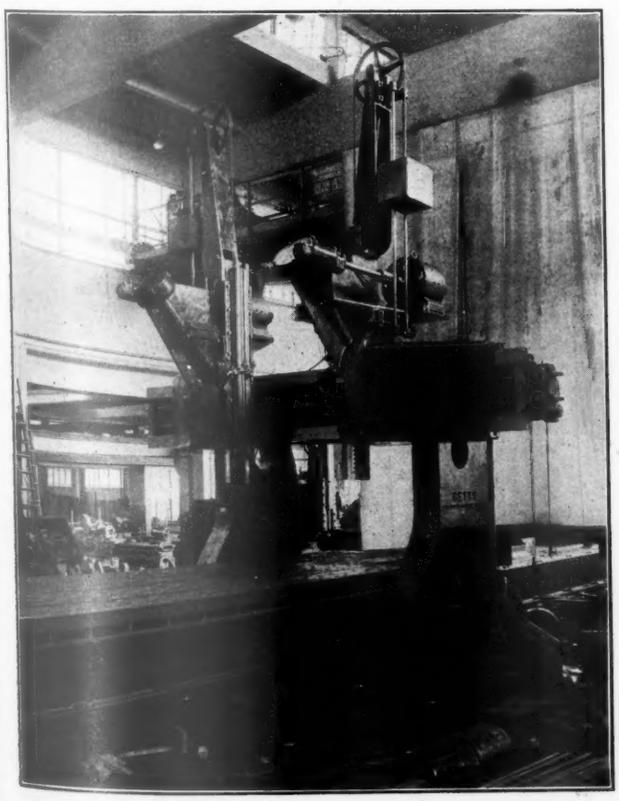


This Machine Is Suitable for Tapping Holes up to 3/16 in. Diameter

A Large Special Planer Type Slotter

A LARGE special machine tool of unusual design has recently been built by the Betts Machine Works of the Consolidated Machine Tool Corporation of America. This tool was built for railroad practice and is capable of performing operations on unusually large work.

The bed and table of the machine are of the conventional planer design. The bed has one vee and one flat track for guiding the table, both of which are automatically lubricated by means of oil pockets and rollers. The table has suitable tee slots and stop holes properly spaced for conveniently clamping the work.



A Betts Planer Suitable for Large Work in Railroad Practice

Fastened to the bed are two heavy uprights carrying a fixed crossrail of unusually wide face and deeply arched at the back. The crossrail carries two saddles, which in turn carry the slotting rams and, owing to the fact that provision must be made for angular slotting, these rams face each other. They are carried by swiveling saddles, which makes it possible to slot at a maximum angle of 2 in. with a 12-in. stroke. The saddles are swiveled by means of a worm and segment.

Each ram is driven by a 20-hp. reversing planer type motor with full automatic control and provision is made by electrical synchronization for keeping both rams working in unison. The motors are carried directly on the saddle and the drive to the rams is by means of the Betts angular shaft drive through a special multiple thread worm meshing with a straight tooth rack. Each ram is counterweighted by means of a unique arrangement employing a guided sliding weight. All important saddle bearings have forced feed lubrication from a power-driven pump. The rams have adjustable cutting and return speeds by means of planer type control panels.

The saddles have feed and power rapid traverse along the crossrail which are driven by a 15-hp. electric feed motor. Provision is made for selecting feed or power rapid traverse, or engaging or disengaging either one from the floor at the operator's position, which adds much to the convenience of operation in view of the height of the machine.

The table has feed and power rapid traverse along the bed, and these movements are driven by the same motor which actuates the saddle movements on the crossrail. An interlocking arrangement is provided so that the saddle and table motion cannot be engaged at the same time.

The machine has a capacity of 10 ft. 2 in. between the housings, 5 ft. under the saddles, and the slotting rams have a 48-in. stroke. The table is 30 ft. long between the pockets and has a width of 9 ft.

A Sliding Head, Self-Oiled Drill and Tapping Machine

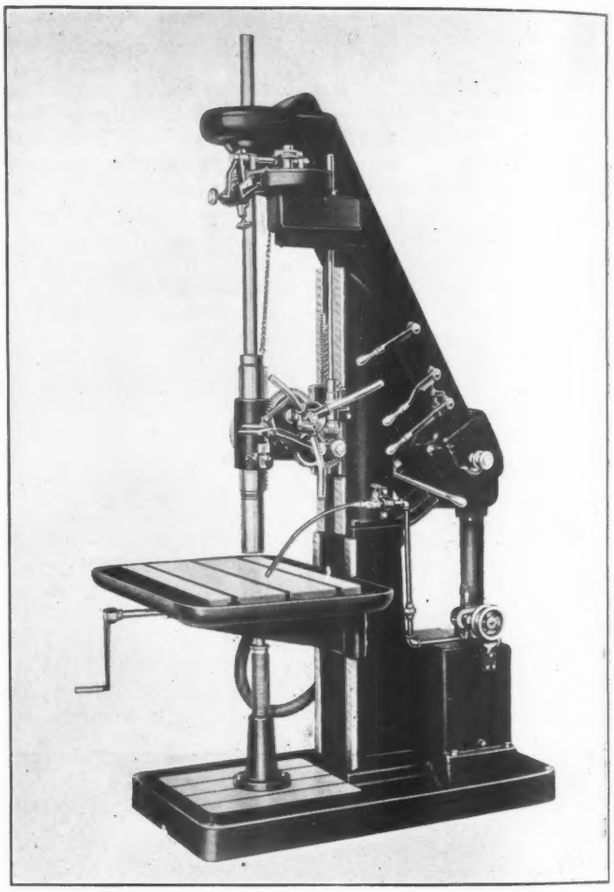
AN upright drilling and tapping machine embodying several improvements has been added to the list of drill presses manufactured by the Barnes Drill Company, Rockford, Ill. The machine develops exceptional pulley power, occupies a minimum of floor space, and is conveniently arranged for ease and speed of manipulation.

The machine is provided throughout with ball bearings, which are lubricated by a self-oiling system. The friction is reduced to a minimum on all shafts in the speed change transmission, including the crown gear and drive shaft bearings, by thirteen radial ball bearings. The oil is forced to the various parts of the machine from a reservoir by a pump. This system of oiling provides a continuous flow of oil to the multiple disk clutches and ball bearings.

A spur geared feed takes the place of the usual worm and worm gear. The reduction of this gear gives a speed as fine as .005 in. per revolution of the spindle. The rack is dovetailed into the spindle sleeve to take the thrust and is keyed in position. This is considered an improvement over the ordinary method of using screws and dowels. The machine is provided with eight geared speeds and feeds which are directly under control of the operator. Any speed or feed may be used without stopping the machine.

The spindle is exceptionally large and is double splined. The sleeve is 3½ in. in diameter and has a 15½-in. travel. The drift hole is below the sleeve. The head is gibbed to the column face by means of a dovetailed construction which insures perfect alinement. It is raised and lowered easily and quickly by means of a crank pinion operating in a rack and is held at any point within the long travel by two quick-acting clamp screws. An adjustable stop is supplied to clamp in the column face so that the sliding head may be instantly brought back to exactly the same place each time the head is raised. The spindle and head are counterbalanced by a weight which is suspended by a roller bearing sheave wheel.

For tapping, the machine is provided with a friction clutch mechanism the gears of which are on the driving shaft rather than on the spindle. An automatic reversing mechanism is used to reverse the spindle. A reverse speed of 1¾ to 1 is provided at the clutch, which is geared down to 13 to 1 in front of the multiple disk clutch gears. The trip can be set so that the instant the tap reaches the depth required the spindle will automatically reverse, backing out at the increased speed. The shifting lever can be set so that when tripped automatically it will return to neutral position, thus stopping the spindle instantly instead of reversing it.



This Machine Is Provided With a Self-Oiling System and a Dovetailed Rack

Coach Shop of the Canadian Pacific at Angus, Near Montreal, Quebec

GENERAL NEWS

The Carnegie Institute of Technology, Pittsburgh, Pa., has established a special research bureau of metallurgy which will begin its work the first of September, 1924. The express object of the new department is to apply to metallurgical questions the recent discoveries in the field of physics and chemistry. Dr. Francis M. Walters, Jr., has been appointed Director of the new bureau and Dr. Vsevolod N. Krivobok has been appointed assistant. The appointment of another assistant, a specialist in X-Ray work, will be made during the summer months.

Electric Locomotive Development

"The Development of the Electric Locomotive" is the title of a paper presented before the Society of Mechanical Engineers at Cleveland, Ohio, on May 29, 1924, by A. H. Armstrong, General Electric Company. The paper includes specific information on twin geared and gearless electric locomotives and presents the reasons for these types being favored by the General Electric Company for heavy traction service.

City Cannot Force Shops to Stay

The Supreme Court of Missouri has decided against the city of Cape Girardeau in its suit asking for an injunction to compel the St. Louis-San Francisco to maintain and operate its repair shops in that city. The court affirmed the principle, established in previous cases, that municipalities have no power permanently to fix conditions of operation upon a railroad or public utility, in the terms of franchises granted. One justice dissented.

Court Decisions

FUSE PLUGS ON BOILERS—BOILER INSPECTION ACT.—The Texas Court of Civil Appeals holds that, while the Federal Boiler Inspection Act does not require the railroads to furnish boilers absolutely safe under all the conditions common to the service, and there are no regulations requiring boilers to be equipped with fusible plugs, the railroad would not thereby be absolved from liability for accidents resulting from the omission to furnish a fusible plug, "if so simple a device was essential to the safety of a boiler."—Schaff v. Perdue (Tex. Civ. App.), 254 S. W. 151.

Canadian Court Decides American Arch Co. Case

The Superior Court of the Province of Quebec, District of Montreal, in an opinion rendered by Justice Duclos in the case of the American Arch Company vs. the Canuck Supply Company, Ltd., has held that the defendant company has infringed the Canadian patents of the plaintiff company. Justice Duclos issued a permanent injunction enjoining and restraining the Canuck Supply Company, Ltd., the Canadian Fire Brick Company, and their officers, agents and employees from further infringing the patents in question and also ordered an accounting of all the profits made by the defendant by the use of the invention in question since February 10, 1920.

A. R. A. to Investigate Locomotive Service

The board of directors of the American Railway Association announces the appointment of a joint committee of the operating and mechanical divisions to make a study of the utilization of locomotives to determine *A* the percentage of time that should be available to perform actual transportation and *B* the methods for obtaining maximum efficiency while so available.

The joint committee will consist of the following representatives of the operating division, A. E. Ruffer, transportation manager, Erie; T. B. Hamilton, general manager, northwestern region, Pennsylvania; J. T. Gillock, general manager, Chicago, Milwaukee & St. Paul. Representing the mechanical division are F. H. Hardin, chief engineer, motive power and rolling stock, New York Central; O. S. Jackson, superintendent motive power and machinery, Union Pacific; W. H. Fetner, chief mechanical officer, Missouri Pacific.

Wage Statistics for March

Class I railroads reported a total of 1,760,268 employees for the month of March, 1924, a decrease of 56,211, or 3.1 per cent, compared with the number reported for the same month last year, according to the monthly bulletin of wage statistics published by the Interstate Commerce Commission. This decrease occurred chiefly in the number of shop employees. The total compensation in March, 1924, was 5.5 per cent less than in March, 1923. The straight time hourly earnings for the employees reported on an hourly basis increased from 55.9 to 57.8 cents, but the overtime hourly earnings decreased from 80.8 to 80.5 cents. Owing to a decrease in the number of straight time hours worked per employee, and a considerable decrease in the amount of overtime, the employees averaged 214 hours per employee in March, 1924, as against 227 hours in March, 1923, with the net result that their average compensation per month decreased from $136 in March, 1923, to $132 in March, 1924.

Passenger Locomotive Performance on the S. P.

Four sections of the Sunset Limited and six sections of the Golden State Limited, making ten trains in all, left Los Angeles on May 22, 1924, each train being hauled by one of the Southern Pacific's new mountain type locomotives all the way through from Los Angeles to El Paso, distance 815 miles. No trouble was experienced, and all ten of these trains arrived at El Paso on time.

On the same day the Overland Limited, consisting of three sections, left San Francisco carrying passengers on the first day of the summer tourist rate excursions; each section being hauled by one of the new mountain type locomotives, and every section arrived on time at Ogden; and furthermore, arrived on time at Omaha, the terminus of U. P. R. R. Co. and at Chicago, the destination.

The Overland Limited, consisting of twelve cars, is now hauled regularly over the Sierra Nevada mountains, with maximum grades of 116 feet to the mile, with one of the Southern Pacific's new freight locomotives (2-10-2) with no helper locomotive.

Concrete Railway Cars

Iron and wood floors in railway cars in Germany may be replaced by cement if experiments recently conducted there prove successful. A composition known as Eisenbeton, or iron wood, had been used in the construction of the floors of railway freight cars with a great measure of success. The first car was built jointly in 1919 by a railway car manufacturer and a Portland cement concern in Heidelberg. The car, it is reported, withstood concussion at a speed of 27 kilometers and shifting tests were so satisfactory that after five years of service it still remains in perfect condition. The new type of car weighs 20 tons. In appearance it is much the same as an ordinary steel car. The cost of manufacture is said to be much less than for iron, although the concrete car is much heavier. However, in the opinion of the builders, the elimination of the danger of rust tends to offset this disadvantage. The car with the concrete floor requires so little repair, it is reported, in comparison with wood and iron cars that the railway administration is favorably impressed. A company for the manufacture of these cars has been formed at Darmstadt.

New Haven Trying Out New Seating Arrangement in Suburban Cars

The New York, New Haven & Hartford has placed in suburban service out of New York two cars which have been remodelled to increase their seating capacity, by seating three persons on one side of the aisle and two on the other. Each of the cars has a different seating arrangement, one having reversible seats, as in the standard day coach, while in the other car the seats are back-to-back and fixed, similar to the seats in a Pullman sleeping car. The seating capacity of the standard day coach which has

been in use on the New Haven is 75. Under the re-arrangement of seats, the car with reversible seats will accommodate 104, an increase of 29 seats; the car with fixed seats will have 33 additional seats, or 108.

The train on which these cars are in service has been running at the 10-car limit, with a seating capacity of 750 and there have been daily from 50 to 60 passengers standing. It is not practicable to increase the number of cars on the train. However, with the substitution of the two remodelled cars the company expects every passenger will have a seat.

New Freight Car Repair Plant

The Southern Pacific has completed plans for the construction of a freight car repair plant at Houston, Tex., and will begin construction at once. The repair plant and tracks will cover an area of 30 acres which will be filled in to uniform elevation. Two repair yards will be built, one for heavy repairs with a capacity of 130 cars and the other for light repairs with a capacity of 191 cars. These yards will contain a total of approximately 45,000 ft. of track. The shop building for heavy repairs will be 400 ft. long and will accommodate four tracks. A shop and mill building 208 ft. by 40 ft., will also be constructed. Plans also include a shop with 3,200 sq. ft. of floor area which will be used for preparing and assembling wheels and axles. This building will be equipped with boring mills, lathes and wheel presses and will have a depressed track with a concrete platform and mechanical equipment for handling wheels, axles and other heavy parts. Store and supply buildings will also be constructed. The buildings will be of slow burning mill construction covered with asbestos protected metal. The mill will be equipped with automatic sprinkler system and a complete air service system will be installed for the operation of compressed air tools. Construction is to be completed this year.

Detroit & Ironton Electrification

Visible evidence of progress toward electrification of the Detroit & Ironton Railroad may be seen in the Rouge erecting shops, according to the last issue of the Detroit, Toledo & Ironton Railroad News.

Nearly all parts to be used in assembly of the first locomotive are in readiness and the construction will begin probably not later than the middle of July. The locomotive will be 117 ft. long, of the 0-8-8+8-8-0 type. There will be a motor for each of the 16 driving axles. The total weight of the locomotive will be 340 tons and the maximum tractive effort 200,000 lb. The first of the eight turbines which will furnish power for the electrification has passed successful operating tests. It will generate 62,500 hp. A 23,000-volt alternating trolley will be used in conjunction with low voltage motors operating on 600 volts direct current. Metal forms are being made for casting the concrete catenary supports.

Of 6,184 locomotives inspected by the Bureau of Locomotive Inspection of the Interstate Commerce Commission during May, 2,931 or 47.4 per cent were found defective and 382 were ordered out of service, according to the Interstate Commerce Commission's monthly report to the President on the condition of railroad equipment. The number ordered out of service was less than had been reported in any month since January 1, 1923, with the exception of December.

New Southern Shops

This company has awarded a contract for the construction of modern shop facilities for the repair of freight and passenger cars at Hayne, S. C., near Spartanburg, to Dwight P. Robinson, Inc. The buildings will all be of masonry and steel construction with modern arrangements for heating, lighting and ventilation, and new machinery will be installed. The following buildings will be erected: Steel freight car repair shop of fireproof construction, 390 ft. by 108 ft., equipped with electrically operated traveling cranes and served by five tracks; annex machine shop, 130 ft. by 50 ft.; coach shop of masonry and steel frame, 240 ft. by 180 ft.; coach paint shop, 200 ft. by 200 ft., with two-story annex for upholstery and other work, 120 ft. by 40 ft.; the coach and paint shop will each be served by ten tracks and by a transfer table of 80 ft. span in a pit 160 ft. long; storehouse and office, 140 ft. by 55 ft.; wash and locker house for employees, 105 ft. by 35 ft.; wheel shop, 105 ft. by 55 ft.; smith shop, 160 ft. by 100 ft.; planing mill, 160 ft. by 100 ft.; power house, 90 ft. by 50 ft.; oil house, 40 ft. by 25 ft.; dry kiln, 40 ft. by 20 ft.; dry lumber shed, 75 ft. by 25 ft.; scrap dock, 400 ft. by 52 ft.; reclaiming shop, 60 ft. by 35 ft.; a service crane with 60 ft. span in a runway 760 ft. long will be located so as to serve the steel car shop, the smith shop and the wheel shop. Approximately 10 miles of track will be constructed in connection with the plant which will be located on a slight grade from north to south so that bad-order cars, brought in from the north end, can be moved practically by gravity entirely through the shop. It is expected that work on the plant will begin as soon as men and materials can be assembled.

Court News

Cars With Defective Power Brakes Must Be in Rear of Power Brake Cars After Passing Repair Station.—In an action by the government against the New York Central for penalties under the federal Safety Appliance Act, the Circuit Court of Appeals, Third Circuit, certified to the Supreme Court of the United States the following question of law: "May an interstate carrier lawfully operate a car equipped with power brakes past an available repair station to destination when its power brakes, becoming out of order in transit, have been cut out of the power brake system of the train and when more than 85 per cent of the cars of the train are equipped with power brakes controlled by the engineer of the locomotive?"

The Supreme Court answered: "No, unless placed in the train in the rear of all cars having their brakes operated by the engineer."

The action concerned two long freight trains moved from Coalburg, Ohio, via Erie, Pa., to Buffalo, N. Y. All the air brakes were in working order when the train left Coalburg, but soon after the air brakes on three cars, the 10th, 40th, and 44th, became defective, and were cut out.

The engineman continued to operate the brakes on the other 60 cars. At Erie repair men and materials were available but the train was run past this repair station and on to Buffalo. The other train had 80 cars, and the facts in respect to it were substantially the same as above.

The railroad contended that, within the meaning of Section 2 of the Act of 1903, the cars having air brakes which were out of order were not "power-braked cars" while in that condition, and that the law did not require their brakes to be operated by the engineer, as at all times power brakes on more than 85 per cent of all the cars in the train were so operated.

The Supreme Court said, in part: "Hand-braked cars have no air line, and it is necessary that they be placed in the train to the rear of the power-braked cars. The cars having power brakes which became defective and were cut out formed a part of the air line. The air line through each of these cars was used to operate brakes on other cars after as well as before the cut-out cocks were turned. Clearly, they were associated together with the other cars equipped with power brakes. . . . Defendant's contention would permit the hauling, in association with cars having their power brakes operated by the engineer, of 15 per cent of the cars in a train with power brakes in bad order and cut out. This would nullify the provision of Section 2 of the Act of 1903. It must be held that the running of the train from Erie to Buffalo in the condition above described was a violation of the law."

The question whether it was a violation of law to haul defective cars to Erie, the place of the first repair station, while associated in the train with the prescribed minimum, was not involved in the case, and no opinion was expressed upon it.—New York Central v. United States. Opinion by Justice Butler. Decided April 28, 1924.

MEETINGS AND CONVENTIONS

The American Short Line Railroad Association will hold its annual meeting at San Francisco, Cal., on August 13, 14 and 15.

Western Railway Club Elects Officers

The annual meeting of the Western Railway Club was held in Chicago on May 19, at which time the following officers were elected: President, F. H. Hammill, general manager, Chicago & North Western; first vice-president, C. G. Juneau, master car builder, Chicago, Milwaukee & St. Paul; second vice-president, W. G. Black, superintendent of motive power, New York, Chi-

cago & St. Louis; secretary-treasurer, Bruce V. Crandall, editor, Chicago & North Western Railway Magazine.

American Railway Tool Foremen's Assn.

The dates for the 1924 convention of the American Railway Tool Foremen's Association have been changed to September 3, 4 and 5, Hotel Sherman, Chicago. The officers of this association are as follows: G. W. Smith, president (C. & O.); Charles E. Helm, first vice-president (C. M. & St. P.); Geo. Tothill, second vice-president (B. R. & P.); E. A. Hildebrandt, third vice-president (C. C. C. & St. L.); J. A. Duca, secretary-treasurer (C. R. I. & P.). The members of the Executive Committee are as follows: C. C. Kuyper, chairman (I. C.); A. Sterner (C. R. I. & P.); T. W. Henson (Wabash); E. F. Miller (C. & E. I.); R. E. Scully (E. J. & E.).

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin Ave., Chicago.

AMERICAN RAILROAD ASSOCIATION, DIVISION V.—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago.

DIVISION V.—EQUIPMENT PAINTING DIVISION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—J. A. Duca, tool foreman, C. R. I. & P., Shawnee, Okla. Annual convention September 3, 4 and 5, Hotel Sherman, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, A. F. Stuebing, 23 West Forty-third St., New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio. Next meeting September 22-26, inclusive, at Boston, Mass.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill. Annual meeting October 20-24, Hotel La Salle, Chicago.

CANADIAN RAILWAY CLUB—C. R. Crook, 129 Sharron St., Montreal, Que. Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—R. E. Giger, 721 North 23rd street, E. St. Louis, Ill. Meetings, first Tuesday in month, except June, July and August, at the American Hotel Annex, St. Louis.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York, N. Y. Regular meetings second Thursday, January to November. Interim meetings second Thursday, February, April, June, Hotel Statler, Buffalo, N. Y.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—A. S. Sternberg, Belt Railway, Clearing Station, Chicago. Annual meeting Hotel Sherman, Chicago, September 23, 24 and 25.

CINCINNATI RAILWAY CLUB.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meetings second Tuesday, February, May, September and November.

CLEVELAND STEAM RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meeting first Monday each month at Hotel Cleveland, Public Square, Cleveland.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich. Next meeting Hotel Sherman, Chicago, August 19, 20, 21.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. B. Hutchinson, 6000 Michigan Ave., Chicago, Ill.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash St., Winona, Minn. Annual convention September 9 to 12. Hotel Sherman, Chicago.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York, N. Y.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meetings second Tuesday in month, except June, July, August and September, Copley-Plaza Hotel, Boston, Mass.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meeting third Friday of each month except June, July and August at 29 West Thirty-ninth St., New York.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgreb, 623 Brisbane Building, Buffalo, N. Y. Regular meetings January, March, May, September and October.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings second Thursday in month, alternately in San Francisco and Oakland, Cal.

RAILWAY CLUB OF GREENVILLE.—G. Charles Hoey, 27 Plum St., Greenville, Pa. Meetings last Friday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August, Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings second Friday in month, except June, July and August.

SOUTHEASTERN CARMEN'S INTERCHANGE ASSOCIATION.—J. E. Rubley, Southern railway shops, Atlanta, Ga.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St. Cleveland, Ohio. Annual meeting Hotel Sherman, Chicago. September 16, 17, 18 and 19.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 605 North Michigan Ave., Chicago. Meetings third Monday in each month, except June, July and August.

SUPPLY TRADE NOTES

The Locomotive Firebox Company has moved its main offices to 1908 Straus building, Chicago.

The Federal Machinery Sales Company, Chicago, has been appointed representative in the Chicago territory for the U. S. Drill Head Company.

Fred J. Mershon, export sales manager of the Industrial Works, has been placed in charge of the Detroit office with headquarters in the Book building, Detroit, Mich.

J. D. Wallace & Co., manufacturers of portable woodworking machines, is now occupying its new one-story, fireproof factory at 134 South California avenue, Chicago.

Robert Huff, New York representative of the McConway & Torley Co., Pittsburgh, Pa., has removed his office from 2 Rector street to Room 1728, 30 Church street.

The Dale Machinery Company, Chicago, has been appointed the representative in the Chicago territory for the Willard Machine Tool Company, manufacturers of engine lathes.

E. H. Benners and R. W. Benners, railway sales representatives at New York of the American Forge & Machine Co., Canton, Ohio, have removed their office from 2 Rector street to 30 Church street.

P. E. Stouffer, assistant to the general sales manager of S. F. Bowser & Co., with headquarters at Ft. Wayne, Ind., has been promoted to assistant manager of the railroad department, with the same headquarters.

Duncan W. Fraser, vice-president in charge of manufacturing and sales, and Joseph B. Ennis, vice-president in charge of engineering of the American Locomotive Company have been elected directors to fill vacancies.

Philip S. Westcott, formerly assistant car lighting engineer of the Chicago, Milwaukee & St. Paul, with headquarters at Chicago, has been appointed special representative for the Pyle-National Company, with headquarters at Chicago.

N. E. Otterson has been transferred from the New York office of the Osgood Company and has been appointed district sales manager, with headquarters at Chicago, succeeding C. A. Phillips, who has resigned to go into business for himself.

The B. F. Nelson Manufacturing Company, Minneapolis, Minn., manufacturer of roofing, insulating papers and water proof cotton ducks, has moved its Chicago railroad sales office to the Transportation building, 608 S. Dearborn street, Chicago.

The Chicago Cleveland Car Roofing Company has located its New York offices at 3710 Grand Central Terminal. James L. Stark, general eastern sales representative, will be in charge and associated with him will be Samuel V. Gloss and Goeffrey Winslow.

Arthur L. Pearson, assistant vice-president of the Bradford Corporation, with headquarters at Chicago, has been promoted to general manager with general supervision over manufacturing operations and direct charge of the buying of materials and supplies.

C. D. Price, who for many years has been connected with the Industrial Works, Bay City, Mich., recently as traveling service engineer, has been appointed district sales manager of the St. Louis district with headquarters at the Railway Exchange building, St. Louis, Mo.

K. A. Hills, representative of the General Electric Company at Davenport, Ia., has been promoted to manager, with the same headquarters. S. E. Gates, manager of the Spokane, Wash., office, has been transferred to Los Angeles, Cal., and will be succeeded by Bernard Olsen.

Frank E. McKellip, general foreman car repairer, of the Michigan Central, has resigned to become general foreman of the pipe shop of the Industrial Works, Bay City, Mich. Mr. McKellip will have charge of the installation of all the air brake and piping equipment on Industrial cranes.

The Railway Service & Supply Company and the Transportation Devices Corporation, Indianapolis, Ind., manufacturers of power reverse gears and cut-off control for locomotives have opened a branch office at 332 S. Michigan avenue, Chicago. W. C. Miner, sales manager, has been placed in charge.

George R. Hine is now in charge of the factory management of the New Process Twist Drill Company, Taunton, Mass. Mr. Hine served as general superintendent of the Whitman & Barnes Manufacturing Company, Akron, Ohio, for the past 15 years and was associated with that company for over 23 years.

J. A. Turner, formerly purchasing agent of the Mobile & Ohio, has been appointed representative of the Fairmount Railway Motors, Inc., with headquarters in the Transportation building, Washington, D. C. L. R. Payton has been appointed representative, with headquarters in the Railway Exchange building, St. Louis, Mo.

B. J. Wilson, formerly with the Simmons-Boardman Publishing Company at Chicago, has been appointed western representative of the Pocket List of Railroad Officials published by the Railway Equipment & Publication Co., New York. Mr. Wilson's headquarters are at 605 Fisher building, Chicago. He succeeds Leo Ehlbert.

The Buffalo Forge Company, Buffalo, N. Y., will open on June 2 a new western office at Seattle, Wash. Arthur T. Forsyth of the Buffalo plant will be western representative in charge of the new office. The territory of this office will include the states of Oregon, Idaho, Montana and Washington and the territory of Alaska.

W. J. Roehl has been appointed a sales agent in the railway department of the Newport News Shipbuilding & Dry Dock Company with headquarters in the Railway Exchange building, St. Louis. J. S. Sheafe has been appointed to a similar position with headquarters at 7356 Woodlawn avenue, Grand Crossing, Chicago.

J. W. Hathaway

John Wesly Hathaway, assistant vice-president of the Union Draft Gear Company, with headquarters at Chicago, whose death occurred at Naperville, Ill., on March 23 was born in 1870, in Missouri, where he attended the public schools. In his early life he was employed as a carman and a foreman on the Missouri Pacific, the Denver & Rio Grande, the Colorado Southern and other western roads. In the early part of 1910 he was general foreman in the car department of the St. Louis-San Francisco, with headquarters at Kansas City, Mo., and in the latter part of that year he entered the employ of the Union Draft Gear Company in the sales department, which position he held until his death.

The Gisholt Machine Company, Madison, Wis., has purchased the business of the Milholland Machine Company, Indianapolis, Ind., including the stock of finished machines, parts in process, good will, trade mark, patents, drawings, jigs, tools and fixtures and will continue the manufacture and sale of Milholland machines at Madison.

The Sykes Company, manufacturers of the Sykes rail car has moved its general office at Kenosha, Wis., and its plant at Winthrop Harbor to St. Louis, Mo., where the general offices are located in the Liberty Central Trust building. A contract has been closed with the St. Louis Car Company for all coach and truck work.

S. F. Taylor, of the S. F. Bowser Company, Fort Wayne, Ind., has been appointed eastern representative of its railway sales division. Mr. Taylor has held many responsible positions with the Bowser Company over a period of fifteen years. He will have contact with all railroads having offices in New York City and other eastern points.

The Continental Railway Supply Company, Peoples Gas building, Chicago, has been organized by O. E. Quinton, secretary and treasurer of the Burry Railway Supply Company, Chicago, to sell railway truck and car specialties, including roller bearings, center plates, springs, contact shoes and bus heating equipment. Mr. Quinton is president of the new company.

Robert F. Horsey, for the past six years office manager of the order department of the National Lock Washer Company, Newark, N. J., died suddenly on May 12. Mr. Horsey entered the employ of the National Lock Washer in 1912 and for six years served in the sales department. On September 1, 1918, he was appointed manager of the order department and office manager.

Leigh Best, senior vice-president at New York of the American Locomotive Company, died on April 27 in the Roosevelt Hospital, New York. Mr. Best was born on November 4, 1867, at Chatham, N. Y. After studying law with a Utica firm he entered the legal department of the New York Central where he became assistant to President S. R. Callaway, and when the American Locomotive Company was organized, Mr. Callaway went to that company as its first president and took Mr. Best with him as secretary. Mr. Best subsequently became vice-president of the American Locomotive Company, which position he held at the time of his death. He was also at that time vice-president of the American Locomotive Sales Corporation, the Montreal Locomotive Works, the Richmond Locomotive Works and the Ware Manufacturing Company.

Leigh Best

The Goodwin Side Bearing Company, Inc., with office at 110 East Forty-second street, New York City, has been organized with the following officers: Douglas I. McKay, president, E. G. Goodwin and W. Eckels, vice-presidents, and E. F. Pride, secretary and treasurer. This company will manufacture and sell roller side bearings for railway cars.

B. Franklin Paist, formerly night superintendent of the Baldwin Locomotive Works, died on June 1, at the age of 70. Mr. Paist had been connected with the Baldwin plant for about 48 years. He traveled extensively as a representative of the locomotive works, and during the World War was one of the contingent of American engineers who went to Siberia, serving with the rank of major.

The Pittsburgh Testing Laboratory is now occupying its new laboratories and office building on Stevenson and Locust streets, Pittsburgh, Pa. The building is a five-story, brick-concrete structure, well lighted, ventilated and fully equipped with the most improved types of accurate physical testing machines and chemical apparatus so that all determinations can be accurately performed.

W. C. Peters, New England department manager at Boston, Mass., of the National Railway Appliance Company, New York, has been appointed manager of sales and engineering with headquarters at New York, to succeed W. C. Lincoln resigned. F. M. Richards, salesman in the New York Office, has been appointed New England department manager at Boston, to succeed Mr. Peters.

Janon Fisher, chairman of the board of directors of the Boyden Steel Corporation, Baltimore, Md., recently sailed from New York for London. Mr. Fisher's trip is in connection with an inquiry recently received by the corporation from the high commissioner of the South African Railways for the use of Boyden six-wheel co-ordinating trucks on proposed new and modern equipment. He will also devote considerable time to the corporation's foreign patent situation.

The Continental Railway Supply Company, Chicago, has purchased the manufacturing and distribution rights for the Hartman center plate and side bearings for electric railways from the Burry Railway Supply Company. This company also has been appointed representative of the Mitchell Spring & Manufacturing Company, Johnstown, Pa., manufacturers of coil and elliptic springs for both steam and electric equipment, in the central, central western and southwestern states.

The Mitchell Spring & Manufacturing Company, Johnstown, Pa., has taken over the business of the W. G. Mitchell Spring Works, manufacturers of coil and elliptic springs for steam and electric railway equipment. Fred A. Meckert, general manager of the Ft. Pitt Spring & Manufacturing Company, is president, Joseph Irwin, formerly superintendent of the Ft. Pitt Spring & Manufacturing Company, is superintendent, W. G. Mitchell is vice-president, and L. Harvey Mitchell is treasurer.

John Meeker High, manager of sales, railroad department of the Pantasote Company, Inc., New York, died suddenly of diphtheria in his fifty-fourth year, on April 24, while on a business trip in Chicago. John Meeker High, after a few years' business experience on the Pacific coast, came to New York, and in 1897 became associated with the Pantasote Company, Inc., in the sales department. His advancement was rapid, and in a few years he became manager of sales in the steam and electric railway fields, in which he established a very wide acquaintance and many strong friendships. In 1910 his jurisdiction was extended to cover also the management of sales of a large variety of railroad products known as Agasote and Pantasote. At the time of his death he was also secretary and director of the Agasote Millboard Company of Trenton, N. J., and a director of the Tuco Products Corporation.

J. M. High

Work has been started on a new building seven stories high to include about 180,000 sq. ft. for the Western Electric Company at Allegheny avenue, Clearfield, Ormes and B streets, Philadelphia, Pa. The new building will be used as a telephone distributing house, and it will include office, warehouse and shop space. The building is being erected by a realty corporation, and upon its completion will be turned over to the Western Electric Company on a twenty-year lease. The entire project will cost about $900,000.

The Gibb Instrument Company, Bay City, Mich., announces that its Chicago office is now in charge of W. F. Hebard & Co., 551 W. Van Buren street. Thos. Barnes, an officer of the Hebard Company, will head the welding department. He will be assisted by Chas. Watson, who has had many years of service with the Gibb Instrument Company both in Japan and in the United States. Mr. Hurd, who has represented the Gibb Instrument Company for the past five years, will look after the interests of the company in New England after August 1.

The Marlin-Rockwell Corporation, on April 1, took over the business, trade name and good will of the Gurney Ball Bearing Company. The officers of the Marlin-Rockwell Corporation are: F. W. Gurney, chairman of the board, Henry K. Smith, president, Alfred C. Davis, vice-president and general manager, and John H. Walters, treasurer, with headquarters at 402 Chandler street, Jamestown, N. Y. The management, policy and product of the Gurney Ball Bearing Company will be continued by the new corporation along the same lines as heretofore.

Charles Longenecker, formerly sales engineer with the Bonnot Company at Canton, Ohio, has become associated with the Combustion Engineering Corporation, New York City. Mr. Longenecker was one of the first men to specialize in pulverized fuel and he has been active in this field for many years past. In his new connection he will be identified with the recently created industrial department of the Combustion Engineering Corporation. This department, in charge of H. D. Savage, will specialize in the application of pulverized fuel to industrial work of all kinds.

W. F. Weller, assistant to the vice-president in charge of engineering, of the American Locomotive Company, died suddenly on June 26, in New York City. Mr. Weller entered the service of the Richmond Locomotive Works in 1896 as secretary to the president, Joseph Bryan. Later, upon the formation of the American Locomotive Company, he went to New York as assistant to Mr. Sague, mechanical engineer of the company. He remained in that position until Mr. Sague resigned, since which time he had served as assistant to the vice-president in charge of engineering.

J. H. Slawson, formerly vice-president and general manager of the Joliet Railway Supply Company, Chicago, has been appointed manager of the newly created brake beam department of the Chicago Malleable Casting Company, with headquarters at 435 Railway Exchange building, Chicago. C. A. Benz, formerly assistant general manager of the Joliet Railway Supply Company, has been appointed assistant manager of the brake beam department. The new department has been created for the manufacture of A. R. A. No. 2 and 2-plus brake beams and other railway devices.

J. H. Williams & Co., makers of superior drop forgings and drop-forged tools, having completed the transfer of the manufacturing operations of their Brooklyn, N. Y., and Chicago, Ill., factories to their Buffalo Works, announce that their district sales offices and warehouses will be maintained at 77 Spring street, New York, and 117 No. Jefferson street, Chicago. In New York, E. J. Wilcox will be sales manager of stock, and P. Rigby of special products for the eastern territory, while at Chicago, N. P. Linde will be in charge of stock, and A. C. Nuth in charge of special products for the western territory.

F. J. Lisman & Co., 24 Exchange Place, New York, has announced that it is prepared to assist railways in financing on the installment plan, purchases of new shop machinery and tools or improvements to shops, terminals, etc. In the announcement, F. J. Lisman & Co. says that it was a pioneer 30 years ago in handling equipment trusts before such obligations were as popular as they are today. The company is convinced that great saving in the operation of railroads, can be brought about by the modernizing of shops and division terminals so as to enable the railways to repair to better advantage the heavy equipment of the present day.

Pullman Company Separates Activities

In accordance with plans for the segregation of the sleeping car and manufacturing operations of the Pullman Company, the Pullman Car & Manufacturing Company has been organized with a capital stock of $50,000,000 to take over the entire business and operations conducted by the manufacturing department of the Pullman Company in its plants at Pullman (Chicago), Ill., and Michigan City, Ind. The capital stock, which will be held in the treasury of the Pullman Company, represents the appraised value of the manufacturing properties. Officers of the new company are: President and treasurer, D. A. Crawford, formerly vice-president and assistant to the president of the Pullman Company; vice-president, Clive Runnells, formerly a vice-president of the Pullman Company; vice-president, C. A. Liddle, formerly a vice-president of the Pullman Company; and secretary, S. W. Gehr, formerly attorney for the Pullman Company. Mr. Crawford was born in St. Louis,

D. A. Crawford

Mo., on April 1, 1880, and graduated from the University of Wisconsin in 1905. After serving for two years as an instructor at the university he was appointed secretary to E. F. Carey, vice-president of the American Car & Foundry Company. Five years later he was elected assistant secretary of the company and on January 13, 1916, he was elected treasurer of the Haskell & Barker Car Company. He held the latter position until the consolidation of the Haskell & Barker Car and Pullman companies on January 14, 1922, when he was elected a vice-president of the Pullman Company, which position he held until his recent election. Mr. Runnells was born in Des Moines, Ia., on September 10, 1877, and graduated from Harvard University in 1900. He entered the employ of the Chicago Junction Railway Company in the same year and in 1904 entered the employ of the Pere Marquette as commercial agent, with headquarters at Chicago, which position he held until 1905, when he entered the employ of the Western Steel Car & Foundry Company. In 1907 he was made vice-president of McCord & Co., railway supplies, Chicago, and in 1910 he entered the employ of the American Car & Foundry Company, at Chicago. From 1911 to 1915 he was a partner in Babcock, Rushton & Co., stocks and bonds, and in 1915 he entered the employ of the Pullman Company as assistant to the president. He held this position until May, 1917, when he was promoted to vice-president and assistant to president, which position he has held until his recent advancement. Mr. Liddell entered business as an employee of the Allison Manufacturing Company, Philadelphia, Pa., and was later associated in turn with the Jackson & Sharp Company, the Harlan & Hollingsworth Company at Wilmington, Del., and the Pressed Steel Car Company, at Allegheny, Pa. In 1901 he entered the employ of the American Car & Foundry Company as an engineer and was later promoted to assistant to the vice-president and then to general manager, which position he resigned on January 1, 1916, to become vice-president of the Haskell & Barker Car Company. On January 14, 1922, he was elected a vice-president of the Pullman Company, which position he has held until the present reorganization.

Clive Runnells

C. A. Liddle

John W. Fogg, manager of railroad sales, has been promoted to assistant to the vice-president of the Boss Nut Division of the American Bolt Corporation. Mr. Fogg was born in England and moved to Canada when a small boy. He entered railway service with the Grand Trunk and in 1885 came to the United States and served as a locomotive engineer on the Wisconsin Central and later on the Chicago Terminal Transfer which was taken over by the Baltimore & Ohio. Later he became traveling engineer of the Chicago Terminal Transfer and in 1901 was made master mechanic with headquarters at Chicago. In 1915 he left the employ of the Baltimore & Ohio to become sales representative of the Boss Nut Company which position he held until 1919. In the latter year he was promoted to manager of railroad sales.

TRADE PUBLICATIONS

Air Hoists and Trolleys.—Several types of air hoists and trolleys are described in a circular recently issued by the Hanna Engineering Works, Chicago, Ill.

Welders and Cutters.—A 31-page illustrated catalogue has been issued by the Burdett Service, Chicago, descriptive of oxy-acetylene and oxy-hydrogen welding and cutting apparatus.

Machine Shop Tools.—Expanding mandrels, drill and reamer holders and arbor presses comprise the trio of time savers described in Bulletin No. 424 recently issued by W. H. Nicholson & Company, Wilkes-Barre, Pa.

Grinder Chucks.—Circular H, descriptive of pressed steel grinder chucks made in nine sizes to hold 10-in. to 30-in. rings, with hubs to suit all kinds of spindles, has recently been published by the Graham Manufacturing Company, Providence, R. I.

Fans.—The constructional features and applications of fans of the Ventura disk and Sirocco types are outlined in Bulletins Nos. 1613 and 1002, respectively, which have recently been issued by the American Blower Company, Detroit, Mich. Tables of dimensions and capacities are also given.

The Loco-Recorder.—The reasons for the loco-recorder on road engines, and the construction, application and operation of the Models K and S-E loco-recorders are described in detail in a graphically illustrated catalogue recently issued by the Distance-Speed Recorder Company, New York.

Portable Car Hoist.—Bulletin No. N-1452 (0.6389), descriptive of a portable car hoist which combines four operations in one, has been published by the Whiting Corporation, Harvey, Ill. This is a two-page folder, the illustrations showing the manner in which the hoist may be applied to car repair work.

Hytempite.—"Hytempite in the Power Plant" is the title of a 20-page illustrated bulletin issued by the Quigley Furnace Specialties Company, New York. Firebrick masonry; hytempite, why, where and how to use it; boiler furnace economies, etc., are among the details of furnace construction and maintenance described.

Packings.—A short story in pictures entitled "Quality Controlled Packings Have the Same Service Stamina Today and Tomorrow as They Had Yesterday," has been issued by the Garlock Packing Company, Palmyra, N. Y. The booklet contains a number of actual photographs as made in the general factories of the Garlock Packing Company.

Bench Grinder.—The "Hisey" six-inch bench grinder driven either by a. d. c. or a. c. one-quarter horsepower motor is described in bulletin No. 1305-A, recently published by The Hisey-Wolf Machine Company, Cincinnati, Ohio. The machine is well provided with standard safety guard, is equipped throughout with ball bearings and is designed only for very light grinding.

Oil as Fuel.—Bulletin "D," a 13-page brochure entitled "Co-operative Advertising of Oil as Fuel," has just been issued by the Mahr Manufacturing Company, Minneapolis, Minn. This bulletin contains a copy of the paper presented by W. M. Horner, president of the Mahr Manufacturing Company, at the first annual meeting of the American Association of Oil Burner Manufacturers held on April 2 at St. Louis, Mo.

Automatic Surface Grinder.—An 11-page illustrated circular has been recently issued by the Blanchard Machine Company, Cambridge, Mass., descriptive of the Blanchard automatic surface grinder No. 16-A. This booklet is devoted principally to illustrations of various classes of work handled on this machine, giving complete production data in each case and a brief description and specifications for the machine itself.

Vanadium Steel.—A 32-page brochure, devoted primarily to illustrations of various types of locomotives equipped with vanadium steel forgings, has recently been issued by the Vanadium Corporation of America, New York. The physical properties of carbon-vanadium steel for locomotive and other forgings, are given in table form. In the captions under each of the illustrations

are listed the forgings for which carbon-vanadium steel was specified.

SMALL TOOLS.—The Brown & Sharpe Manufacturing Company, Providence, R. I., has just issued a new small tool catalogue No. 29, in which over 2,000 precision measuring tools are illustrated and described. Many tools of new and improved design are included, and over 45 styles and 3,000 sizes of milling cutters, gear cutters and hobs are listed. Tables of weights and measures, etc., are also contained in the catalogue, which is 4⅝ in. wide by 6⅝ in. long.

PAINT.—A bulletin has been issued by the Eagle-Picher Lead Company, 208 South La Salle street, Chicago, setting forth the advantages of painting with sublimed blue lead, and furnishing specifications for its use. While the major portion of the bulletin is devoted to a consideration of blue lead, attention is also given to other products manufactured by the company, including paint pigment ground in oil and dry and metal products, numbering in all 24 varieties.

FEED WATER HEATERS.—The second edition of a preliminary catalogue on Elesco feed water heaters has just been issued by the Superheater Company, New York. It describes construction details and fully illustrates the application of the closed, or non-contact heater to locomotives. Of special interest are the four charts in colors at the center of the catalogue, which illustrate the operation of Elesco feed water heaters and the heat balance of locomotives with and without feed water heaters.

HEATING SYSTEMS.—A 235-page, illustrated catalogue, No. 24, has recently been issued by the Gold Car Heating & Lighting Company, Brooklyn, New York. This catalogue, which is of a size convenient for either the pocket or desk, has been prepared for the convenience of all employees coming in contact with the operation and maintenance of car heating systems, making it possible for them, when ordering repair parts as well as complete equipments, to ascertain the correct number or letter and thus avoid unnecessary correspondence and delay.

BRICK PAVEMENT CONSTRUCTION.—The National Brick Paving Manufacturers' Association, Cleveland, Ohio, have issued a 92-page book, bound in cloth, which comprises a treatise on modern brick pavement. The subject is treated in a logical sequence with chapters on drainage, grading, curbs, bases, etc., followed by discussions of the pavement itself. The book is amply illustrated with line drawings of sections of pavement and half-tone reproductions of photographs of a large number of pavements and roads throughout the country. While dealing primarily with pavements, attention is also given to roadways, station platforms, etc.

POSTAL CAR LIGHTING.—The Safety Car Heating & Lighting Company, New Haven, Conn., has issued a 1924 edition of its catalogue on Postal Car Lighting. The catalogue describes conduit, wiring and fixture installations which conform to post-office department specifications and it is distinctive in publications of its kind in that it is, in reality, a text-book on the subject of postal car lighting. It contains 77 pages and is profusely illustrated. It contains post-office department specifications on lighting, descriptions of electric and gas lighting equipment and layouts for 70-ft. and 60-ft. mail cars, and for 30-ft. and 15-ft. mail compartments.

CASTINGS.—"Heat Enduring Castings," a 20-page illustrated brochure dealing with the subject of alloys suitable for the production of castings exposed to temperatures as high as 2,100 deg. F., has been published by The Calorizing Company, Pittsburgh, Pa. This book, based on many years of experience in the production of heat-enduring alloys by the General Electric research laboratory, Victor Hybinette and the engineers of The Calorizing Company, contains an outline of the work of Mr. Hybinette, what heat resisting and heat enduring mean, the field of usefulness of any alloy limited by temperature range, and other interesting data.

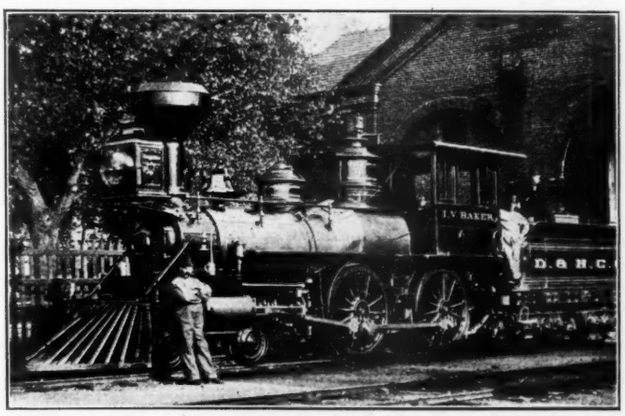
SUPERHEATED STEAM PYROMETERS.—The Superheater Company, New York, has just issued a second edition of its instruction book covering the installation, operation and maintenance of the Model 496 superheated steam pyrometers. While the book is intended primarily to give instructions covering the application of the pyrometer to superheater locomotives, special instructions relating to marine and stationary industrial plants are also given. A pyrometer test set is described, also the inspection, test and maintenance of the pyrometer with and without the test set. An added feature of this edition is the order list covering pyrometer parts in the back of the book.

"HIGHER HOLEAGE."—This is the title of a 60-page educational treatise on the art of making holes, which has recently been issued by the Griswold-Eshleman Company, Cleveland, Ohio. The book is divided into eleven chapters, Chapter 1 dealing with the history of holemaking. The subjects taken up in the succeeding chapters are holemaking by electricity; electric drills—the machine guns of industry; higher holeage—lower costs; unusual uses of Van Dorn drills; holes in a hurry—for shop repairs; the buying of drills for holeage; operation and care of electric drills; electricity vs. air for drilling purposes; tools recommended for various wood drilling operations, etc.

LOCOMOTIVE VALVE GEAR.—An 88-page brochure, descriptive of the Young locomotive valve gear, Type B, has been issued by the Pyle-National Company, Chicago. The booklet is divided into eleven chapters, Chapter I defining many technical terms that are in common use, but which are not always correctly interpreted. Chapter II describes the indicator card, and Chapter III the valve ellipse. Chapter IV gives a general description and details of the Young valve gear, and Chapter V, an explanation of the principles of motion of the gear. Chapter VI is devoted to valve setting; Chapter VII, to breakdown instructions; Chapter VIII, to general information; Chapter IX, to locomotive operation; Chapter X, to locomotive tests, and Chapter XI, to the earning power of a locomotive.

BRITISH MACHINE TOOLS.—The British Machine Tool Trades' Association, London, England, which was formed in 1910 for the purpose of holding and regulating exhibitions and for dealing with all matters of general interest to manufacturers of machine tools, including woodworking machinery, and engineering supplies, has endeavored to provide foreign buyers with a standard work of reference, covering various products manufactured by its members. This reference, an alphabetically arranged catalogue of 407 pages, gives complete data regarding codes, telegraphic and cable addresses, principal agents, etc., of the advertisers listed therein, and illustrated descriptions of the products advertised. Spanish and French editions of the catalogue, which is 11 in. by 8 in., bound in cloth, are now in the process of preparation.

LOCOMOTIVE BOOSTER.—Instruction book No. 101 has recently been published by the Franklin Railway Supply Company, N. Y. The text contains a general description of the locomotive booster and its elements. The three principle parts of the booster —the engine, the booster control and control system—are gone into in detail by means of text and illustrations. The piping arrangement and control parts of the booster using either saturated or superheated steam are described by means of colored charts which also contain the names of all parts of the device. Complete instructions are included in the text for assembling and checking the crank arm and crank pin and for pressing on the crank arms. Eighteen questions and answers are given in a chapter pertaining to operating instructions. Questions arising in the daily terminal maintenance of the booster are covered by 17 questions and answers in the last chapter.



D. & H. Locomotive "I. V. Baker"

PERSONAL MENTION

General

H. F. Wall, who has been on leave of absence, has resumed his duties as mechanical superintendent of the Atchison, Topeka & Santa Fe, Coast lines, with headquarters at Los Angeles, Cal.

R. G. Bennett, superintendent of motive power of the Central Pennsylvania division of the Pennsylvania, with headquarters at Williamsport, Pa., has been transferred to the Eastern Ohio division, with headquarters at Pittsburgh, succeeding F. G. Grimshaw.

E. B. De Vilbiss, master mechanic of the Eastern division, with headquarters at Canton, Ohio, has been appointed superintendent of motive power of the Central Pennsylvania division of the Pennsylvania, with headquarters at Williamsport, Pa., succeeding R. G. Bennett.

F. G. Grimshaw, superintendent of motive power of the Eastern Ohio division of the Pennsylvania, with headquarters at Pittsburgh, Pa., has been appointed general superintendent of motive power of the Southwestern region, with headquarters at St. Louis, Mo., succeeding E. W. Smith, promoted.

Master Mechanics and Road Foreman

J. L. Butler has been appointed master mechanic of the Missouri Pacific, with headquarters at Dupo, Ill.

Gilbert Bisson has been appointed master mechanic of the Copper Range, with headquarters at Houghton, Mich.

G W. Lloyd, assistant road foreman of engines of the Chesapeake & Ohio at Russell, Ky., has been transferred to Covington, Ky.

Edward Clark has been appointed master mechanic of the Cornwall, with headquarters at Lebanon, Pa., succeeding John Wintersteen, promoted.

J. B. Merrill has been appointed master mechanic of the Montgomery division of the Louisville & Nashville, with headquarters at Montgomery, Ala., succeeding T. F. Ryan.

J. A. Sheedy, assistant master mechanic of the Meadows, N. J., shops of the Pennsylvania, has been appointed master mechanic of the Eastern division, succeeding E. B. DeVilbiss.

Stephen I. Palmer, traveling engineer of the Trenton division of the Pennsylvania, has been appointed assistant road foreman of engines of the same division, succeeding B. W. Steelman, deceased.

William Fite, fuel supervisor of the Cincinnati and Northern divisions of the Chesapeake & Ohio, has been promoted to assistant road foreman of engines of the same divisions, with headquarters at Russell, Ky.

F. R. Butts has been appointed assistant master mechanic of the Hannibal division of the Chicago, Burlington & Quincy, with headquarters at Hannibal, Mo., succeeding J. J. Simmons, who has been assigned to other duties.

T. F. Ryan, master mechanic of the Montgomery division of the Louisville & Nashville, with headquarters at Montgomery, Ala., has been transferred to the Birmingham division, in the same capacity, with headquarters at Boyles, Ala., succeeding F. J. Monahan, deceased.

W. F. Heinbach, master mechanic of the Reading at Philadelphia, Pa., has been appointed master mechanic of the Reading and Harrisburg division, with headquarters at Harrisburg, Pa., succeeding G. A. Dugan, resigned. Mr. Heinbach was born on March 21, 1877, at Schuylkill Haven, Schuylkill County, Pa., and entered the employ of the Philadelphia & Reading as a machinist at Reading, Pa., in 1899. In 1901 he was transferred to Harrisburg, Pa., and from 1902 until the time of his recent promotion as noted above, he served successively as enginehouse foreman at Rutherford, East Penn Junction, Bridgeport and Erie avenue, Philadelphia, Pa.

Car Department

T. V. Robinson has been promoted to car foreman of the old shops of the Missouri Pacific at Sedalia, Mo.

J. C. Fritts, master car builder of the Delaware, Lackawanna & Western, with headquarters at Scranton, Pa., has resigned and the duties heretofore performed by Mr. Fritts have been assumed by C. J. Scudder, superintendent of motive power and equipment.

P. Kass, general foreman, car department, of the Chicago, Rock Island & Pacific, at Chicago, has been promoted to superintendent of the car department, with the same headquarters, succeeding E. G. Chenoweth, who has been granted leave of absence.

Shop and Enginehouse

F. D. Wright has been appointed general roundhouse foreman of the Erie, with headquarters at Hammond, Ind., succeeding W. H. Williams, deceased.

W. A. Bender, general foreman of the Chicago, Milwaukee & St. Paul, with headquarters at Green Bay, Wis., has been appointed superintendent of shops of the Missouri Pacific, at St. Louis, Mo.

C. J. Wiard, division foreman of the Chicago, Rock Island & Pacific at Caldwell, Kans., has been appointed general foreman, with headquarters at El Reno, Okla., succeeding J. W. Finch, resigned.

Purchasing and Stores

George Sheridan has been appointed division storekeeper of the Chicago, Milwaukee & St. Paul, with headquarters at Mobridge, S. D., succeeding D. H. Phebus, promoted.

H. R. Toohey, chief clerk to the general storekeeper of the Chicago, Milwaukee & St. Paul, at Milwaukee, Wis., has been promoted to assistant district storekeeper at Minneapolis, Minn., succeeding G. A. J. Carr.

G. A. J. Carr, assistant district storekeeper of the Chicago, Milwaukee & St. Paul, with headquarters at Minneapolis, Minn., has been promoted to district storekeeper, with headquarters at Deer Lodge, Mont., succeeding J. V. Miller, who has resigned.

F. J. Bereck, general purchasing agent of the Chicago & North Western, with headquarters at Chicago, has also been appointed general purchasing agent of the Chicago, St. Paul, Minneapolis & Omaha, with the same headquarters, a newly created position.

Obituary

F. J. Monahan, master mechanic of the Louisville & Nashville at Boyles, Ala., died on Tuesday, May 20.

J. H. Clemmitt, purchasing agent of the Norfolk & Western, with headquarters at Roanoke, Va., died on May 23. Mr. Clemmitt was born on November 20, 1881, at Richmond, Va., and entered railway service on October 16, 1896, with the Norfolk & Western. His entire railway service was with the Norfolk & Western.

William H. Lewis, formerly superintendent of motive power of the Norfolk & Western, who retired from active service in November, 1918, died in Chicago on June 4. Mr. Lewis was born on October 18, 1845, at Syracuse, N. Y., and entered railway service in 1861 as a machinist apprentice on the New York Central. He was employed on the Chicago, Burlington & Quincy as a machinist in 1864, and in 1869 was promoted to locomotive engineer. Mr. Lewis was appointed general master mechanic on the Northern Pacific in 1873, and he held that position until 1878, when he was appointed division foreman on the Kansas Pacific, now a part of the Union Pacific. He was appointed master mechanic on the Oregon Short Line in 1882, and two years later was appointed master mechanic on the New York, Chicago & St. Louis. In 1888 Mr. Lewis was appointed master mechanic on the Chicago, Burlington & Northern, now a part of the Chicago, Burlington & Quincy, and he held this position until July 1, 1897, when he was appointed superintendent of motive power of the Norfolk & Western. He remained in that position until his retirement in 1918.